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THE GAS JOURNAL

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A Glance at the Contents—

Fatal Gasholder Accident in Copenhagen.

An accident with fatal results occurred on Jan. 10 at the Western Gas Works, Copenhagen, during the dismantling of a gasholder. Details are given on a later page to-day.

Co-Operation With Builders and Architects.

Mr. W. M. Mason, Manager of the British Commercial Gas Association, speaking on Jan. 29 at a special gathering of architects and builders at the Edinburgh Housing Exhibition, referred to the increasingly valuable co-operation of the gas industry with architects and builders in finding practical solutions to modern building problems.

Opening of the New Smethwick Showrooms.

The opening of the new Smethwick Showrooms, an illustrated description of which was published in last week's issue of the "JOURNAL," took place on Jan. 28, being preceded by a luncheon at the Crockett's Lane Technical Schools, over which the Mayor (Alderman S. Smith) presided, and at which there were speeches by Sir Arthur Duckham and Sir Francis Goodenough.

Gas Light and Coke Company Report.

We publish to-day the report of the Directors which will be submitted to the proprietors at the general meeting of the Gas Light and Coke Company on Friday next. The accounts for the year show that, after the payment of dividends, which, together with the further sum of £20,000 to be contributed to the redemption fund, will absorb £682,078 14s. 11d., a sum of £122,055 7s. 7d. will be carried forward to the credit of the current year.

South Metropolitan Gas Company Report.

Published to-day is the Directors' report for the year ended Dec. 31, 1930, which is to be presented at the general meeting of the South Metropolitan Gas Company to-day. Notwithstanding an increase in the number of consumers, there has been a slight decrease in the past year's consumption of gas owing to the comparative mildness of the weather experienced in the early months of the year. The gas not accounted for is now below 1 p.ct.

"Pushing Electricity."

Our correspondence columns to-day contain letters on this subject from Mr. S. S. Ogilvie, Mr. W. R. Herring, and Mr. W. Higgs, all protesting against the propaganda by the Minister of Transport in favour of a semi-Governmental electricity supply. Further articles in our news columns also refer to this matter, particularly in connection with the electricity conference recently held in Leeds, where Mr. Lister Cooper attempted to speak on behalf of the Gas Industry but was refused a hearing.

Co-Partnership Activities.

Co-Partnership activities in two well-known gas companies are reported this week—that of the Lea Bridge Company, when Mr. A. M. Paddon, Chairman of the Company, made some interesting statements; and also a social gathering at Hastings, when co-partners, their wives, and friends were entertained.

Carbonization in Continuous Verticals.

In a paper before the Scottish Junior Gas Association (Western District) recently, Mr. W. A. Currie, of the Provan Gas-Works, Glasgow, dealt with various aspects relating to the carbonization of coal in continuous vertical retorts. Among the matters referred to are the effects of temperature on carbonization, the rate of carbonization, coal size and swelling power, segregation in bunkers, and control of the factors affecting carbonization.

Electricity Competition.

This subject is discussed by Mr. A. E. Hutchison, of Sydney, in a paper before the Australian Gas Institute. He explains that inspection and maintenance of appliances are receiving attention by the different companies in Australia, but there is great scope for useful work in this direction. "To retain the domestic load," he says, "goodwill is essential. To retain goodwill, good service is imperative. My view is that gas companies should be prepared to spend at least 3 p.ct. of their revenue in what is called 'free inspection and maintenance' work."

Country Gas-Works Management.

In a paper before the Australian Gas Institute, Mr. C. E. Taylor expresses his conviction that an "inferiority complex" exists in the gas industry to-day. "Staff training," he says, "is most essential for the future, and yet it is a curious fact that a board of directors will spend £5000 in new plant and buildings, and will refuse to spend £15 on efficient work on staff training to increase the present output of the business." His view is that country gas-works managers should regard the district first and the works second.

Incomplete Combustion.

In a paper before the London and Southern District Junior Gas Association on Jan. 30, Mr. E. W. B. Dunning, B.Sc., A.I.C., of the Research and Training Section, Watson House, Gas Light and Coke Company, dealt with the question of incomplete combustion, its importance, recognition, and prevention. The combustion of gaseous compounds, he stated, is not always effected in one single reaction, but may be in a series of stages. The speed with which these stages follow one another varies with the method of combustion. There are two main causes of incomplete combustion—viz., an insufficient supply of air in the right place, and flame chilling.

EDITORIAL NOTES

In the Middle of the Window

THE value of the British Industries Fair is inestimable, and signs are not lacking that this value is being more and more appreciated. It has been well said that it represents Britain's greatest shop window.

The gas industry must remember that, in the Birmingham Section of the Fair, the special Gas Section puts our industry in the middle of the window. The national organization of the industry, ably supported by some eighty of its manufacturers, is staging a wonderful window display. It remains for gas engineers throughout the country to uphold the prestige of their industry by attending themselves, and allowing their staffs to attend, in such numbers that the Gas Section shall always appear a real live section of the Fair. The psychological effect of a truly business-like atmosphere cannot be overestimated, and the Gas Section is so advantageously placed in the Fair that all visitors must pass through it. The industry has, therefore, a really excellent opportunity for national advertisement on a large scale. We all know that our success must be built very largely upon public opinion and goodwill.

In the Gas Industries Section at Birmingham very many thousands of the most influential people of our own and foreign countries will have brought to their notice a thoroughly representative and peculiarly well organized epitome of the activities of our industry. It will help them to realize to some extent its magnitude and the ramifications of the service which our industry gives to the community. We must not take it for granted that this service is already well known. On the contrary, if the great utility of the gas industry to the nation was fully appreciated, its rate of expansion would be very much more rapid. Because we do enjoy a very considerable expansion year by year we are apt to think that all is well; but there is no doubt that if only the utility and capabilities of gas were better known—if only we could interest the public in the advantages we have to offer in home and factory—this expansion would be more rapid, and the whole position of our industry would be enormously improved.

Professor Burstall, speaking at the British Industries Fair only two years ago, said that the greatest fault of the gas industry was its modesty. In spite of a measure of progress that has since been made, his indictment is true to-day. With a public utility that has so much to offer reticence is entirely out of place. This point was brought out by Sir Francis Goodenough when speaking at the luncheon which preceded the opening of the new gas showrooms at Smethwick. From the report of the function, which appears in this issue of the "JOURNAL," it will be seen that Sir Francis emphasized the necessity for telling the consumers all the time all that the gas industry was prepared to do for them. It was, he said, the bounden duty of any public utility undertaking that had a monopoly of the supply of its commodity in any district to give full publicity to the service it was prepared to render. To take but one field as an example, all the developments of modern civilization have combined to present problems for which gaseous fuel is the only solution.

In the home, the great dearth of domestic labour has accentuated a demand for labour-saving appliances. The gas fire and gas cooker supply the answer, for we must remember that fire making and the preparation of food have always represented the bulk of the housewife's labour. An improvement in personal hygiene and a more broadly distributed participation in outdoor recreation have brought about a vastly increased demand for an ample and ready supply of hot water for bathing throughout the year. Gas is the solution to the hot water problem. Science has shown that the race is being starved of sunlight, and gas and its smokeless bye-product coke represent the only practical solution of the smoke problem. In the purely industrial world gaseous fuel supplies the answer to two pressing demands—better conditions for the workers, and ever-increasing accuracy and precision in all heat-treatment processes. One could extend almost indefinitely the advantages our product has to offer to the civilized world to-day. As the Chairman of the Birmingham Gas Department, Alderman J. H. Lloyd, so truly said at the British Commercial Gas Association Conference last October, "there are few ways in which money can be spent to-day which show so good a return as expenditure on gas."

This is the lesson we have to teach the nation. Our manufacturers have spared no pains in making the Gas Industries Section an attractive object-lesson to industrialists, and indeed to everyone who visits the Fair. It is the duty of every gas engineer and administrative chief to give his whole-hearted support to the Section, to show his interest by visiting it in person and by giving facilities to his staff to do likewise. It will be time and money that will be amply repaid. It is a unique opportunity for the engineer to confer with his colleagues, to test the pulse of opinion in his industry, and to pick up the threads of all new developments which the past year has evolved. Every junior and every salesman who visits the Section must of necessity go back to his job with a wider vision, with a fuller appreciation of how difficulties are being tackled in other localities, and in all probability with the solution of some at least of the problems that he meets from day to day. Throughout industry conditions are such as to demand increased effort and activity. The road is uphill, and the going is heavy; all must lend a hand if the wheels are to be kept moving.

The Gas Section is organized for the benefit of the industry as a whole, and only if the whole of the industry supports it can the fullest value be obtained from the effort. We feel sure that by their presence gas engineers will mark their appreciation of, and assist in, the efforts that are being made to secure the advancement of their industry.

The Joint Gas Conference

WE have in the above article urged gas engineers and managers throughout the country to attend the Fair in the largest possible numbers, and it may be added that an excellent opportunity for doing so will be provided by the Joint Gas Conference under the auspices of the Institution of Gas Engineers, the Society of British Gas Industries, the British Commercial Gas Association, and the National Gas Council, which is to take place at Castle Bromwich, on Tuesday, Wednesday, and Thursday, Feb. 24, 25, and 26. An interesting programme of proceedings has been arranged, and will be found elsewhere in this issue. Sir Arthur Duckham will preside, and will deliver his address at the opening meeting on the Tuesday morning. This meeting will be followed by an Official Gas Industry Luncheon, and the afternoon, as will be the case on the two other days, will be devoted to an inspection of the exhibits at the Fair. On the Wednesday (when Sir Arthur Duckham will be supported by Mr. H. E. Copp, President of the Institution of Gas Engineers) Dr. C. H. Lander will give an address on "The Gas Industry and Its Relation to the Fuel Problems of Great Britain," and on this day the proceedings will be followed by luncheon at the invitation of the Fair Management Committee. When he takes the chair on the Thursday, Sir Arthur Duckham will be supported by Mr. John E. Daw, President of the British Commercial Gas Association, and on that occasion there will be an address by Sir Francis Goodenough on "The Principles of Salesmanship."

A programme of this kind—on which those who have organized the Conference are entitled to be congratulated

—provides ample inducement for attendance, even without the attraction of the Fair, which it is a national duty to support. We shall therefore be greatly disappointed if the Conference is not an outstanding success from the point of view of the numbers attending, as it certainly will be from that of the fare provided. Anyone desirous of further information will receive it on application to the Hon. Secretary of the Conference, Mr. H. C. Smith, at 639, High Road, Tottenham, and those who are intending to be present and have not yet made arrangements for accommodation should do so without delay.

Accounts of the Gas Light and Coke Company

It will be remembered that the winter and spring of last year were exceptionally mild, and, in common with most gas undertakings, the Gas Light and Coke Company's sale of gas during that period was in consequence adversely affected. The report for 1930 states, however, that a satisfactory increase was recorded during the second half of the year, but this was not sufficient to make up for the decrease in the earlier half, and the sale of gas during the whole year showed a decrease of 2½ p.ct. The number of consumers increased by 25,617 (against 23,320), and no fewer than 90,382 (against 89,473) additional gas stoves were sold or let out on hire. No change was made during the year in the price of gas, which remains at 8⅝d. per therm, and is still the lowest price among the three Metropolitan Companies.

The report adds that the Company have deposited a Bill in Parliament to provide, *inter alia*, for the transfer to the Company of the Southend-on-Sea and District Gas Company and the Brentwood Gas Company, and for the introduction of the basic price and dividend principle.

Turning to the details of the accounts, the total capital expended during the year was £1,005,467, or £248,341 more than for 1929, and was made up of £53,900 for land, £255,213 for buildings and machinery, £465,646 for mains and services, and £230,708 for meters and stoves. Against these items, £117,155 has been written off, leaving a net addition of £888,312 to the capital expended for the year. The total capital expended to date, less the amount redeemed, is £22,324,933, the cost per therm sold being 1s. 10·17d., against 1s. 8·47d. in 1929. On the credit side of the capital account £701,492 (net) has been added to the amount raised, representing the stocks of the Grays and Tilbury and Pinner Gas Companies as converted on Jan. 1, 1930, while £40,195 ordinary stock has been redeemed. The Company issued £2,500,000 of 4½ p.ct. redeemable debenture stock in the autumn, which was very largely over-subscribed; but as the final instalment on this did not become due until the beginning of the current year, the issue is not dealt with in the present accounts.

Comparing the principal items of the revenue account with those of the preceding year, including the figures of the Grays and Tilbury and Pinner Companies, it is seen that:

	Gain. £	Loss. £
Coals and oil, &c., cost less by	15,059	
Residuals realized less by		74,499
		15,059
Net coals and oil, &c., cost more by		59,440
Carbonizing wages were less by	19,664	
Repairs and maintenance of works and plant cost less by	118,521	
Distribution cost more by		59,499
Rent, rates, and taxes were less by	42,641	
Other items cost more by		3,636
	180,826	122,575
Deducting	122,575	
Leaves a net gain on expenditure of Gas, rentals, &c., realized less by	58,251	131,258
		58,251
Leaves the balance of the revenue account less by		£73,007

The net profit is £1,326,668, and after adding the amount brought forward, £160,670, including the undivided balances of the two Companies absorbed, and providing for the dividend on the ordinary stock at £5 12s. p.ct. per annum, the preference and other dividends, and a transfer of £40,000 to redemption fund, there remains a balance to be carried forward of £122,055.

Of the variations in expenditure, the decrease in the cost of coal and oil, &c., is apparently due to the reduced make of carburetted water gas, and the saving in the cost of oil and coke included therein. The cost of coal alone, however, was more by £75,426 by reason of the slightly higher price (3d. per ton) and of the larger quantity carbonized—2,855,114 tons (a record quantity), against 2,773,789 tons. The large saving in repairs to plant, &c., is noteworthy, and the cost per therm is 1·82d., against 1·90d. for 1929. The increase under distribution was largely due to higher costs under the heading of salaries and wages and repairs to meters. A gratifying feature is the large decrease of £42,641 in rent, rates, and taxes. On the receipts side, gas alone, after allowing for public lighting repairs, was less by £182,812, while rentals increased by no less than £48,726. The loss on residuals was due entirely to the further reduction in the selling prices of both tar and ammonia; the receipts for coke and breeze exceeding the previous year by as much as £103,140.

A comparison of the working results with those of a year ago, so far as obtainable from the published accounts, shows that the unaccounted-for gas is slightly more at 4·03 p.ct., against 3·91 p.ct.; coke made for sale per ton of coal is practically the same at 10·10 cwt.; and the percentage of coke used as fuel is a trifle higher at 19·01 p.ct. Coals cost 20s. 7·81d. per ton, against 20s. 4·63d.; but, on the other hand, coke realized nearly 1s. 1d. per ton more at 21s. 1·15d. As was expected, tar realized less at 2·65d. per gallon, against 3·37d.; but the most disappointing feature in the residual figures is the loss of £16,047 on ammoniacal liquor and sulphate of ammonia, as compared with a profit of £77,549 in 1929. The make of water gas was less by 5·48 p.ct., at 23·94 p.ct. of the total gas made.

There is little variation in the costs per therm sold. The total expenditure, less residuals, was 7·97d. (against 7·76d), the gross profit being 1·82d. (against 1·86d.). Dividend and interest were 1·80d., and contributions to funds and sundry payments 0·06d., leaving a small deficit of 0·04d. per therm on the year.

South Metropolitan Gas Company's Working

Notwithstanding an increase in the number of consumers, the report of the South Metropolitan Gas Company for 1930 states that, owing to the mild weather, the sale of gas shows a slight decrease compared with the previous year. An outstanding feature is the remarkably small quantity of gas "not accounted for," which is now below 1 p.ct. of the total quantity made. The report also contains a protest against the attitude adopted by the Minister of Transport in furthering the interests of the electrical industry, and in this connection says:

> A comparison between the United States of America and this country is so often made in regard to the consumption of electricity that it should be pointed out that in the former country the suppliers of electric and of gaseous energy have been left to compete for business as commercial undertakings, existing for the general weal and without discouragement of either by the Government. In this country, on the other hand, the Minister of Transport has seen fit to throw the weight of his influence into the scale on the side of the interests of electricity, and therefore to that extent to the detriment of gas. It is obvious that the arbitrary displacement and compulsory exclusion of gas in favour of electricity must involve a definite loss of business to the gas undertaking. An industry which for more than a century has fulfilled, and is fulfilling, a great purpose in the economic utilization of the country's coal resources, which in London alone gives employment to some thirty thousand persons, excluding

those employed in ancillary undertakings, and which continued to function unaided when electric power stations had to be manned by naval ratings during the general strike, surely deserves better recognition from the Government responsible for the health and welfare of the country.

The capital expended during the year on buildings, plant, and machinery, and district appliances, was £238,271, against the comparatively very small sum of £37,681 in 1929. On the credit side of the capital account an increase in the amount raised is shown by the issue, in July last, of £1,000,000 of 5 p.ct. redeemable debenture stock and £635,812 of 6 p.ct. preference stock. The latter is the amount of stock exchanged for £691,100 Commercial Gas Company's ordinary stock in accordance with the working agreement made during the year between the two Companies. The credit balance of the capital account is now £533,870.

Turning to the revenue account, the gross profit is £569,068, against £570,610 for 1929; and after providing for the interim dividend of 2½ p.ct. and debenture and other interest (*less* dividends received on the South Suburban stock) for the year, there remains a balance of £254,229 available for the final dividend recommended at the rate of 3¾ p.ct., which will absorb £251,621, leaving a small balance on the year's working.

Comparing the principal items of expenditure with those of the previous year it is found that:

	Gain. £	Loss. £
Coals cost less by	20,220	
Residuals realized less by		31,140
		20,220
Net coals cost more by		10,920
Carbonizing wages were less by	4,652	
Repairs and maintenance of works and plant cost less by	67,025	
Distribution cost less by	36,710	
Rents, rates, and taxes were more by		22
Other items cost more by		48,011
	108,387	58,953
	58,953	
Leaving a net gain on expenditure of	49,434	
Gas, rentals, &c., realized less by		50,976
		49,434
So that the balance to net revenue was less by		1,542
Dividends (interim and final) and debenture and other interest (less South Suburban dividend) were less by	1,799	
	1,542	
Which leaves a net increase as compared with 1929 of	£257	

Coals cost less by reason of the smaller quantity carbonized—1,250,972 tons, against 1,301,799 tons, though the cost per ton at 19s. 5·49d. is just over 5d. more than for 1929. Tar and ammonia, on account of the further reductions in selling prices, were mainly responsible for the decrease in the residual receipts, which compared separately show that:

	£
Coke realized less by	5,174
Breeze realized more by	3,689
Tar, &c., realized less by	15,523
Ammonia, &c., realized less by	14,132

The extra expenditure on "other items" was due solely to expenses in connection with the issue of stock (£21,543), and the agreement with the Commercial Company (£22,989), together with an increase of £10,000 in the amount transferred to the special purposes fund.

An examination of the costs per therm sold shows that the Company's excellent record for economical working has been well maintained. Manufacture, less residuals, cost 3·98d.; and the total expenditure, less residuals, and the amount placed to the special purposes fund, was 7·72d. Both these figures show a saving on the previous year. The gross profit works out at 1·56d. (against 1·53d.), and dividend and interest at 1·46d., leaving a surplus of 0·10d., while £40,000, equalling 0·10d., was placed to the special purposes fund.

The working results have also been well maintained:

	Year 1930.	Year 1929.
Therms made per ton of coal	76·29	74·82
Coke made for sale per ton of coal (cwts.)	9·66	9·98
Tar made per ton of coal (galls.)	9·94	9·59
Liquor " " " " (")	42·52	40·98
	s. d.	s. d.
Prices realized—		
Coke (per ton)	20 6·72	19 2·34
Breeze (per ton)	1 4·28	0 8·30
Tar (per gall.)	0 2·40	0 2·69
Ammonia (per butt)	1 5·66	2 0·48

As we have indicated, after providing for dividend and interest the receipts only slightly exceeded the expenditure; but the unusual payments in respect of the issue of capital and the Commercial Company's agreement, together with the large amount placed to the special purposes fund, clearly show that the Company have had a very successful trading year.

The Call to Economy

THE real importance of the demonstration which took place at the Cannon Street Hotel on Tuesday of last week, to inaugurate a national campaign for economy, is in the evidence which it affords of a national awakening to the dangers by which the country is beset. The agitation is over-late in getting under way; and the task of the reformers would have been easier had it been taken in hand at an earlier stage. The warning signs have been there for all who would see them, and the "JOURNAL" has done its full share in calling attention to the handicap placed upon industry by public extravagance. But the downward path is easy, and with each increase in momentum the task of pulling up becomes harder, and so things have gone on.

However, now we have had this great meeting, presided over by Mr. E. C. Grenfell, M.P. (Senior Member for the City of London), at which resolutions were carried by an overwhelming majority calling upon the Government and Local Authorities to abstain from all expenditure which is not absolutely necessary, people will be looking for results. There must be general agreement with the views that were then expressed. At the present time industry is burdened with charges which disastrously reduce its power to produce goods at competitive prices. It was emphasized by Sir Robert Horne that this country's weight of taxation is the heaviest in the world; and the rates have gone up since 1900 from £76,000,000 to £175,000,000. National expenditure is £100,000,000 a year more than was the case eight years ago; while debt per head of the population has risen from £18 to £500 since 1914. Again to quote Sir Robert Horne: "Expenditure for Imperial and local services is not only carrying off one-quarter of the nation's income, but it is also, by the excess of death duties over debt payments, taking £20,000,000 a year from capital and treating it as revenue." And the net outcome of all this is, as might be expected, higher proportionate unemployment than anywhere else.

We are faced with a disease which requires desperate remedies, and the first of these remedies is drastic treatment of the demands upon the national income for uneconomic purposes. The meeting referred to above called upon Local Authorities, as well as the Government, to economize, but this is quite apart from such expenditure as we suggested a fortnight ago gas undertakings might wisely indulge in where extensions are called for. The economy is needed, as stated, in connection with uneconomic expenditure. Never was it more necessary than now for gas administrators generally to use every endeavour to be prepared to provide an adequate supply of gas at the cheapest practical price; and extensions and modernization of plant are frequently the only means of attaining these ends. Every day gas increases in importance to industry. Factories of all sorts and sizes depend upon gas for all sorts of processes; and gas never "lets them down." It will not do so now, but will be ready to assist to the utmost of its power in rehabilitating the fortunes of our languishing industries. The determination thus to place themselves in a posi-

tion to help industry by offering plentiful supplies of gas at the lowest price may involve monetary outlay, but this, again, will help industry in another way, and is in no wise to be condemned. Expenditure of the kind is not the "uneconomic expenditure" against which a national campaign has now been opened.

Competition

THERE are many points of interest, particularly to those responsible for the progress of the smaller undertakings, in two papers read before the Australian Gas Institute.

Mr. Taylor, the writer of one, believes that in some quarters of the gas industry of Australia an "inferiority complex" manifests itself. There are some managers of small works, he thinks, who have insufficient faith in the future of gas—an attitude which is unwarranted by events and which is of excellent value to competitors. There never was a time when optimism about gas was more justified, and enthusiasm better calculated to yield good results, than it is to-day; there can be no excuse for hesitating to seize opportunities. And managers of the smaller works, says Mr. Taylor, should appreciate the worth of staff training and the importance of the district as well as the works. "Staff training is most essential for the future, and it is a curious fact that a board of directors will spend £5000 in new plant and buildings, yet will refuse to spend £15 on efficient work on staff training to increase the present output of the business."

Perhaps the most important suggestion which the author makes is in regard to the estimation of true progress. His idea, which has much to commend it, is that increases in sales should be calculated not as a percentage of the previous year's sales, but as a percentage of "potential revenue," the latter being the product of the average consumption per meter and the number of dwellings in the area of supply. "If," he says, "the potential revenue has increased by 3 p.ct. and your sales by 2 p.ct., you have not held your own, irrespective of what the percentage of increase might be on the previous year's sales. If, on the other hand, your sales have increased beyond the percentage increase of potential revenue, then you have made more than natural increase, and due credit must be given to you for your sales efforts." And the author re-enforces the suggestion by outlining what a small undertaking can do, at relatively little expense, to increase the percentage of potential revenue.

In his paper, Mr. Hutchison also deals with the question of competition; and he lays stress on the psychological value of the belief that gas is essentially a modern fuel. It is obvious from his observations that the gas industry is not a little to blame for the notion of part of the public that gas is old-fashioned; and it is equally obvious that enthusiastic sales and service efforts are needed to counteract this notion. Apart from the lighting load, he regards water heating as the field in which electricity has made the greatest inroads into the gas business, and will continue to do so if the gas industry does not pursue a progressive policy. A few years back, he remarks, electricity made substantial progress with storage systems, because there was nothing of a competitive type available for use by gas heating. The new gas-fired automatic storage heater has, however, put a fresh complexion on the matter; and the author explains that recently the Sydney companies introduced a 25 p.ct. discount for gas consumed by storage heaters, and that already there are indications that this will open up many new opportunities for the use of gas for hot water supply. The same experience was related last month by Mr. H. E. Bloor, of York, in an address to the Southern District (London Area) Gas Salesmen's Circle, reported in the January issue of the "Gas Salesman." No one ought to miss the opportunity of reading that report.

PERSONAL

We understand that Mr. FRANCIS H. VINCE has been appointed by the South Metropolitan Gas Company to the position occupied by the late Mr. T. S. F. Gibson, M.Inst.C.E. The advertisement relating to the consequent vacancy at Rotherhithe appears in another column.

Mr. ERIC ANDERSON, Junior Assistant at the Birkenhead Gas Department, has been appointed Technical Assistant to the Ellesmere Port Gas Undertaking.

A complete scheme of re-organization has been approved by the Birkenhead Town Council with regard to the Gas Undertaking, and the new staff appointments are Mr. C. STOTT as Commercial Assistant, and Mr. H. T. OWEN as Engineering Assistant. These follow the recent appointment of Mr. A. COLLARD as Chief of the Outdoor Department. Additions have also been made to the Drawing Office and Chemical Staffs.

The late Mr. ROBERT HALL, a retired Gas Engineer, of St. Andrew's Drive, Glasgow, left personal estate to the value of £1608.

OBITUARY

We are sorry to learn of the death at Malta on Jan. 19 of Mrs. EDITH MARY BUCKLEY, wife of the Engineer and General Manager to the Malta and Mediterranean Gas Company, Ltd. Mrs. Buckley had a large circle of friends in the gas industry both at home and abroad.

The death has occurred of Mr. THOMAS BUTLER, J.P., who for a long period was Managing Director of Messrs. William Butler & Co. (Bristol), Ltd., turpentine and resin importers and tar distillers. After retiring from business some years ago he spent much of his time yachting off the South Coast, but maintained his residence in Bristol and fulfilled his duties as a City Magistrate. Of genial disposition and excellent company, he was welcomed everywhere, and will be much missed in many places.

FORTHCOMING ENGAGEMENTS

Feb. 5.—MIDLAND JUNIOR GAS ASSOCIATION.—Paper by Mr. H. S. Adams (Bilston), "Erection of a New Spiral Gasholder on an Old Site."

Feb. 6.—LONDON AND SOUTHERN DISTRICT JUNIOR GAS ASSOCIATION.—Annual Dinner and Concert, Holborn Restaurant, W.C. 1. President's reception, 6.30 p.m.

Feb. 7.—MANCHESTER AND DISTRICT JUNIOR GAS ASSOCIATION.—Visit to the Chemical and Metallurgical Corporation, Ltd., Runcorn. Paper by a member of their Technical Staff.

Feb. 7.—SCOTTISH JUNIOR GAS ASSOCIATION (WESTERN DISTRICT).—Thesis by Mr. S. McGowan, Glasgow.

Feb. 7.—SCOTTISH JUNIOR GAS ASSOCIATION (EASTERN DISTRICT).—Meeting and Visit to Messrs. Milne's Meters, Ltd., Edinburgh.

Feb. 10.—NATIONAL GAS COUNCIL.—Meeting of Central Executive Board, 28, Grosvenor Gardens, S.W. 1.

Feb. 12.—SOCIETY OF BRITISH GAS INDUSTRIES.—Meeting of Council in the afternoon.

Feb. 18.—Visit of JOINT JUNIOR GAS ASSOCIATIONS to the British Industries Fair, Birmingham. Meeting in the Conference Hall at 11.30 a.m. and address by Mr. Harold E. Copp.

Feb. 20.—Joint visit of B.C.G.A. GAS SALESMEN'S CIRCLES to the British Industries Fair, Birmingham.

Feb. 20.—SOUTHERN ASSOCIATION OF GAS ENGINEERS AND MANAGERS (EASTERN DISTRICT).—Meeting at 2.30 p.m. at 28, Grosvenor Gardens, S.W. 1.

Feb. 21.—YORKSHIRE JUNIOR GAS ASSOCIATION.—Visit to Messrs. W. C. Holmes & Co., Huddersfield.

Feb. 21.—SCOTTISH JUNIOR GAS ASSOCIATION (WESTERN DISTRICT).—Visit to Uddingston Gas-Works.

Feb. 24-26.—JOINT GAS CONFERENCE at the British Industries Fair.

June 2-4.—INSTITUTION OF GAS ENGINEERS.—London Conference.

Oct. 27-28.—INSTITUTION OF GAS ENGINEERS.—Autumnal Research Meeting.

CORRESPONDENCE

Hampering a Vigorous Industry

SIR,—The steady development of the Gas Industry at a time when so much official encouragement is being given to its rival, electricity, is apt to be overlooked. Hampering legislation, no doubt necessary at the time, was imposed when gas was first introduced, but the Industry, which is practically 100 p.ct. British, is still forging ahead, and employs nearly three times as many workers as do the electricity supply undertakings.

The increase in the number of consumers last year is, perhaps, sufficient evidence of the indispensability, the utility, and the popularity of gas; but the whole industry and its 113,000 employees view with the gravest concern the increasing number of unfair restrictions which are being imposed on the use of gas in municipal houses. In nearly 100,000 houses in this country the tenants are not allowed to choose the form of lighting or heating which they prefer.

In no fewer than thirteen districts have local authorities prohibited the use of gas for any purpose whatsover on their estates, and in forty-seven other cases specific uses of gas (*e.g.*, for lighting or for gas fires) are forbidden.

These figures do not include the 26,000 houses upon which the London County Council has placed similar restrictions. In working-class houses in South London candles and oil-stoves may be found in use, simply because tenants are not allowed to have gas, and find that electricity is beyond their means.

British prosperity has, in the past, been built upon fair-play and freedom of enterprise, and when Ministers of the Crown neglect their official duties to further the cause of a particular industry, it is time to protest. May I urge that the gas and electrical industries be placed upon the same basis of freedom, so that they may develop unhampered by official interference?

S. S. OGILVIE
(Joint Manager).

National Gas Council,
28, Grosvenor Gardens, S.W. 1,
Jan. 24, 1931.

The Electricity Campaign: Housing Estates and Gas

SIR,—The "JOURNAL" of Jan. 28 contained a brief report of a meeting of electricity supply authorities at which Mr. Herbert Morrison, the Minister of Transport, was the principal speaker. The meeting was ostensibly called for the purpose of stimulating greater zeal in developing the supply of electricity, and incidentally to relieve unemployment. In the opinion of many, however, the real object of the meeting was to bolster up electricity, in order to justify the enormous expenditure of the Electricity Commission to which the Government are committed. Be that as it may, it is an open question whether such advocacy on the part of a Government official holding the position Mr. Morrison does is strictly within the rules of propriety. At the meeting Mr. Reid called attention to this, and also very properly exposed the fallacy of assuming that the substitution of electricity for gas for domestic purposes would reduce unemployment.

If one-half the expenditure and propaganda were spent in urging a greater utilization of gas for domestic and other purposes, it would have a direct bearing on the coal mining industry, where unemployment is most acute. Moreover, a larger consumption of gas would lower the cost of production, as is claimed for electricity; and what is of even greater importance, it would increase the quantity of residual products which affect a vast field of commercial activities, including the recovery of benzole from coal, a consideration which should appeal in a special way to the Minister of Transport.

As is well known, gas companies are regulated by Acts of Parliament with stringent conditions as to capital expenditure, rate of dividend, price, quality, and pressure of gas supplied, so that in every way there is security for the public. As to the working conditions, it is not without significance that the relationship between gas companies and their employees is of quite exemplary character, due in large measure to the system of co-partnership which obtains in many of the larger undertakings. Under such conditions, every encouragement should be given to those responsible for this branch of the public service. This is not the case, however, for there is a very insidious movement going on among some Local Authorities to check the use of gas for domestic purposes; and it would seem that this movement, if not instigated by, is at least connived at by, the Ministry of Health. A few months ago the matter was raised in the House of Commons, but was dismissed by Mr. Graham, the President of the Board of Trade, in a few curt sentences.

Quite recently the Gas Company with which I have been associated for many years were informed by the Town Planning Officer of the Council that the Housing Committee had decided that electricity only would be allowed in the proposed new houses, and this notwithstanding that the Gas Company offered to lay mains, services, &c., free of cost to the Corporation. To debar the tenants of council-built houses from exercising their right of option to use either gas or electricity for their domestic requirements is a very paltry interference with public liberty. These houses are built with public funds, and it is certainly a very arbitrary position for local authorities to take up, and one which should be resisted to the utmost.

As this is a subject of some general interest, I shall esteem it a favour if you can find room for my letter.

WILLIAM HIGGS,
Gas Engineer (retired), Basingstoke.

Park Close,
Basingstoke,
Jan. 31, 1931.

"Pushing Electricity"

SIR,—I am in full sympathy with your Editorial protest published in the last issue of the "JOURNAL" against the propaganda by the Minister of Transport in favour of a semi-Governmental electricity supply, and had in fact addressed a letter to "The Times" under date of Jan. 27 bearing upon the same subject, as in my view it is the general public who must be impressed by the fundamental difference between the relative merits of the two services, and in this, not the least is cost. I am not satisfied that the Gas Industry is exploiting this point as effectively as it should do. It is not sufficient that we inside the Industry should be convinced; we must also convince that elusive entity "the man or woman in the street" by constant and unwearying reiteration of the fact, and as we are in touch, by means of the accounts, with some nine millions of the public three or four times a year, a few effective paragraphs fairly contrasting the merits of the rival services will be well worth while.

It is not desirable that we should take up other than a cold comparative attitude. Speaking for myself, I prefer electricity for lighting, and if I were building a house, or re-fitting a house, I should be sorely tempted to introduce it; on the other hand, a house already fitted with a gas supply can be as effectively lighted as by its rival.

In so far as domestic heating and cooking are concerned, gas has no rival, not only from the point of view of efficiency, but because it is much less costly. The appliances for heating by electricity remind one of the absurdities that were introduced in the early days of gas heating in so far as their form and substance are concerned. Where domestic hot water supply is concerned, gas has many advantages, but it is a question that would depend entirely upon actual cost as against solid fuel, coke or anthracite, and in this respect it has another rival in the form of sprayed oil. The relative advantages of the three should be carefully analyzed for the Industry, and the facts made known to the "man and woman in the street."

For so-called central heating, here again it should be purely a question of cost, but it must be admitted that central heating by warm water circulation through radiators heated by a low-temperature boiler, operated on solid fuel, will take a lot of beating from the point of view of economy and efficiency, and requires, under thermostatic control, a minimum of attention to maintain an equable temperature in the water circulation. Electricity here has no chance whatever.

Here again the question of oil fuel should be investigated as against solid fuel in the form of small coke or anthracite and results made known to the "man or woman in the street." There are innumerable smaller purposes where gas and electricity may meet on more equable terms of rivalry, but they should be investigated item by item, and solid reasons shown for preference either way, and where we can give our rival a point, we must not be afraid to do so.

The latest figures for the electrical industry seem to show

that the lighting and domestic load is only 25 p.ct. of the total sold. Quoting from official returns relating to electricity supply for the year 1928, there appears to be a total number of nearly three million electricity consumers compared with nearly nine million gas consumers in the same year.

The capital employed per consumer in the Gas Industry works out at £20 per head, as compared with £100 in the case of the electricity industry, the relative totals being

Gas Capital	£185,000,000
Electricity Capital	£297,000,000

The revenue raised per consumer is in the case of gas £8 6s. 8d. per head and electricity £18 6s.—about 20 p.ct. of the gas revenue arising from sale of bye-products.

If we are really determined to arouse public opinion to the reality of our position, then we might act wisely by extending our propaganda into the countryside where oil at present reigns supreme for light, heat, and power, and although we are not yet in a position to extend our service to the extent that the " grid " system will enable electricity to cover districts now under the supremacy of oil, there is no reason why we should allow our rival to gain a footing largely on misapprehension as to costs, which will have the effect of strengthening its ability to compete in areas where gas is at present supplied.

In my own case, I manufacture electricity by means of an oil engine at a cost of 4d. per unit. An oil range is used for all culinary purposes. Broken coke or anthracite nuts is used for domestic hot water supply and central heating, and this practice is common in the countryside, as well as among the farming community generally.

There is another aspect in favour of oil and gas for domestic lighting, and that is the warmth it disperses throughout the dwelling; and where the combustion of gas is so perfect as it is to-day, it has many advantages which are immediately recognized when the warmth arising from this source is absent through the introduction of electric light.

W. R. HERRING.

St. Stephen's House,
Victoria Embankment,
S.W. 1,
Feb. 2, 1931.

Waste-Heat Recovery from Horizontals

SIR,—I would like to thank Mr. E. Strother Davies for the additional information given in his letter appearing in your issue of the 7th inst. There are, however, still a number of points calling for comment.

I showed in my previous letter that the fuel carbonized per day was 32,900 lbs. for each bed. With a consumption of 13·54 p.ct. on the dry ash-free basis the fuel fed to the producers was 0·1354 × 32,900 = 4450 lbs. Taking the figures given in the table in the original paper (p. 862), we get the fuel fed to the producers

$$= \frac{\text{Total heat lost } \textit{via} \text{ waste gas}}{\text{Heat per lb. of fuel fed to producers}} = \frac{19{,}011{,}000}{3877} = 4900 \text{ lbs.}$$

and this is presumably as fired, otherwise why different from 4450 lbs.? Thus the moisture *plus* ash in the coke is

$$100\left(1 - \frac{4450}{4900}\right) = 9{\cdot}2 \text{ p.ct.}$$

From the figures given in the table on p. 26 of your issue for Jan. 7 we have, for the sensible heat in the fuel (apparently excluding moisture since this appears as a separate item):

$$(4900 - w)(t - 32){\cdot}2 = 106{,}155$$
$$\text{and} \quad w(t - 32) = 32{,}497$$

where w is weight of water in the fuel, t its temperature in ° Fahr., and 0·2 the specific heat. Solving these equations, w = 283 and the moisture in the fuel 5·8 p.ct., and the ash therefore 9·2 − 5·8 = 3·4 p.ct.—a remarkably good quality of coke. Incidentally the temperature of the coke fed to the producers as obtained from the above equations is 147° Fahr.

Mr. Davies still contends that 12 p.ct. CO_2 corresponds to 125 p.ct. excess air. Air contains 20·96 p.ct. of oxygen and 70·04 p.ct. of nitrogen (*plus* other inert gases). Regarding coke as being composed of carbon and hydrogen (the latter due to the small quantity of volatile matter present), the action in the producer is represented by—

$$\underbrace{wC + xH_2}_{\text{coke}} + \underbrace{yH_2O}_{\substack{\text{steam and}\\ \text{other water}}} + \underbrace{zO_2 + 3{\cdot}77\,zN_2}_{\text{primary air}} = \underbrace{aC + bH_2}_{\text{hydrocarbons}}$$
$$+ (x - b + c)\,H_2 + (y - c)\,H_2O + (w - a - d)\,CO$$
$$+ dCO_2 + O_2\left(z - d - \frac{w - a - c - d}{2}\right) + 3{\cdot}77\,zN_2$$

The combustion of this producer gas may be shown by—

$$\underbrace{aC + bH_2}_{\text{secondary air}} + (x - b + c)\,H_2 + (w - a - d)\,CO + dCO_2 + (y - c)\,H_2O$$
$$+ O_2\left(z - d - \frac{w - a - c - d}{2}\right) + 3{\cdot}77\,zN_2 + sO_2 + 3{\cdot}77\,sN_2$$
$$= (a + w - a - d + d - k)\,CO_2 + kCO + (b + x - b + c + y - c - l)\,H_2O$$
$$+ \left(z + s - d - \frac{w - a - c - d}{2} - a - \frac{b}{2} - \frac{x - b + c}{2} - \frac{w - a - d}{2} + \frac{k}{2} + \frac{l}{2}\right)O_2$$
$$+ 3{\cdot}77\,(z + s)\,N_2 + lH_2$$
$$= (w - k)\,CO_2 + kCO + (x + y - l)\,H_2O + \left(z + s - w - \frac{x}{2} + \frac{k}{2} + \frac{l}{2}\right)O_2$$
$$+ 3{\cdot}77\,(z + s)\,N_2 + lH_2$$

Theoretical O_2 required per perfect combustion

$$= \left(w + \frac{x}{2}\right)O_2$$

$\therefore$ Percentage excess air $= \dfrac{(s + z - w - {\cdot}5x)\,100}{w + {\cdot}5x}$

Percentage CO_2 in waste gases =

$$\frac{(w - k)\,100}{w - k + k + z + s - w - \frac{x}{2} + \frac{k}{2} + \frac{l}{2} + 3{\cdot}77\,(z + s) + l}$$
$$= \frac{(w - k)\,100}{4{\cdot}77\,(z + s) + {\cdot}5k + 1{\cdot}5l - {\cdot}5x} = 12 \text{ (say)}$$
$$\therefore\ z + s = 1{\cdot}745\,(w - k) - {\cdot}105k - {\cdot}315l + {\cdot}105x.$$
$$\therefore \text{ Percentage excess air} = \frac{({\cdot}745w - 1{\cdot}85k - {\cdot}315l - {\cdot}395x)\,100}{w + {\cdot}5x}$$

For perfect combustion and with coke containing no hydrogen (excluding water)—*i.e.*, when k, l, and x are each zero—then percentage excess air is 74·5 when the CO_2 content is 12 p.ct. When unburnt gases make their appearance—that is to say, as some value is given to k and l, and when x has a value, due to hydrogen in the coke—it is obvious from the above formula that the percentage excess air decreases. The formula does not take into consideration any unburnt carbon in the ashes from the producer. If there are e parts of unburnt carbon for every w parts burnt then the theoretical O_2 required is

$$\left(w + \frac{x}{2} + e\right)O_2$$

the percentage excess air is

$$\frac{s + z - w - {\cdot}5x - e}{w + {\cdot}5x + e}$$

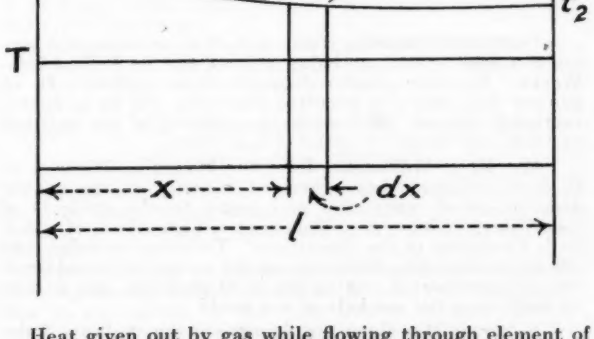
and without further solution it is apparent that the percentage of excess is further decreased by taking into account the unburnt carbon in the ashes. Hence when the CO_2 content of the flue gases is 12 p.ct., the excess air cannot be greater than 74·5 p.ct., and Mr. Davies is in error when he states that 12 p.ct. CO_2 corresponds to 125 p.ct. excess air.

With regard to the effect of the velocity of the flue gases through the boiler tubes on the efficiency of heat recovery, let us consider the case of one of the tubes.

Let

Length of tube	$= l$ ft.
Mean radius of tube	$= r$ ft.
Specific heat of flue gas	$= c$.
Velocity of gas through tube	$= w$ lbs. per hour
Inlet gas temperature	$= t_1$ ° Fahr.
Outlet gas temperature	$= t_2$ ° Fahr.
Temperature of boiling water in boiler	$= T$ ° Fahr.
Overall co-efficient of heat transmission	$= H$ B.Th.U. per sq. ft. per ° Fahr. per hour.

The temperatures along the tube may be represented by the following diagram:



Heat given out by gas while flowing through element of tube of length dx = $wcdt$ B.Th.U. per hour. Heat transmitted to water per hour

$$= 2\pi r dx H\,(t - T)$$
$$\therefore\ wcdt = -2\pi r.dx.H\,(t - T)$$

Integrating between the limits—

$$x = o \text{ and } x = l$$

$$wc \log_e \frac{t_1 - T}{t_2 - T} = 2\pi r H l$$

from which

$$t_2 = \frac{t_1 - T}{e^{\frac{2\pi r H l}{wc}}} + T$$

Neglecting radiation losses the efficiency of heat recovery

$$= \frac{t_1 - t_2}{t_1} = \frac{(t_1 - T)}{t_1}\left(1 - \frac{1}{e^{\frac{2\pi r H l}{wc}}}\right)$$

Now

$$H = \frac{1}{\frac{1}{h_1} + \frac{1}{h_2} + \frac{1}{h_3}}$$

where h_1 is the heat transmission coefficient for the film of gas adjacent to the tube wall, h_2 that for the tube wall itself, and h_3 that for the film of water inside the boiler adjacent to the tube. h_2 is usually so large compared with h_1 and h_3 that the term involving it can be neglected. The efficiency of heat recovery is therefore—

$$\frac{t_1 - T}{t_1}\left(1 - \frac{1}{e^{wc\left\{\frac{1}{2\pi r l h_1 h_3}\right\}}}\right)$$

h_3 depends largely on the amount of agitation inside the boiler, and will probably not vary much. Heastie (Trans. Soc. Chem. Ind., 1923, p. 448T) states that Weber's formula for h_1 is probably the most accurate. Applying this, $h_1 = R\, w^{\cdot 76}\ (t + 459)^{-5}$, where R is a constant. Mr. C. R. McDermott in the quotation given by Mr. Davies states "the dislodging effect of these moving molecules on the molecules of the adhering film will be proportional to the volume of the mass of gas over the heating surface." He does not, however, state that the heat imparted to the surface is *proportional* to the number of gas molecules, but only that it is *dependent* on this number—quite a different thing. Mr. Davies, because of this variation of h_1, a variation which neither Mr. McDermott, nor, so far as I know, anyone else claims to be proportional to the velocity of the gas, w, appears to conclude that the efficiency of heat recovery is proportional to the velocity of the gas. This is clearly without justification. Mr. Davies, however, claims that his own results support his contention, and in that case I would suggest that he publish such results in detail. In doing so he would make a valuable contribution to our knowledge of heat transmission. The figures given in his paper (p. 862 of your issue of Dec. 17) show that as the pressure gradient across the boiler increases from $\frac{9}{10}$ to $\frac{28}{10}$, and therefore as the velocity of the gas through the tubes increases, the efficiency as obtained from inlet and outlet gas temperatures falls from 55 p.ct. to 51·5 p.ct., which is just the reverse of Mr. Davies's contention.

Mr. Davies still maintains that "evaporation per lb. of fuel per hour" is correct, because he calculated the fuel to lbs. per hour and then the water to lbs. per hour. If he had calculated each of these to lbs. per day, per minute, per second, or any other unit of time, he would have obtained the same value for water evaporated per lb. of fuel. I repeat that the "per hour" in this instance is meaningless.

I note Mr. Davies's definition of extraction efficiency, and so long as it is understood and used according to this definition nothing further need be said. It is, however, unfortunate that he should claim it as the true efficiency. Boiler efficiency is always taken to mean

$$\frac{\text{heat utilized}}{\text{total heat available}}$$

and difficulties and misunderstandings are bound to arise if efficiency is held to be one thing for a direct fired boiler and another for a waste-heat boiler.

Item 26 is claimed to be a theoretical assumption of "what approximately should be expected from the waste gases available." What is the significance of the approximately? One would imagine from Mr. Davies's definition of extraction efficiency that item 26 multiplied by this efficiency would give the evaporation per lb. of fuel (item 21), but in no case is this true.

The formula given in Mr. Davies's letter for converting the superheat from ° C. to ° Fahr. is incorrect, the 32 not being required when differences of temperature are being considered.

Mr. Davies suggests that the very dry steam generated explains why the steam temperatures were higher than those given in steam tables. This explanation cannot be accepted.

With regard to the "N.O.C." process, I had hoped that Mr. Davies would give a complete analysis of the feed water and the "blow down water," and if possible the proportion of the latter. In view of the satisfaction he feels about this process, I had also hoped he would state the scientific principles on which it is based because the explanation in terms of polarity given in his paper is very vague. What polarity is given to the boiler metal, and what to the different scale-forming compounds—*e.g.*, $Mg(OH)_2$, $CaCO_3$, $CaSO_4$, which make their appearance as solids as evaporation proceeds? Why are the dissolved gases prevented from exerting their usual corrosive action, and can water with low temporary but high permanent hardness due chiefly to $MgCl_2$ be successfully treated? Is the process to be regarded as one which is highly successful, but of which the *modus operandi* is not yet understood?

D. K. MOORE.

West Hartlepool,
Jan. 25, 1931.

THE NEWS OF THE WEEK

Four New Purifiers, which will effect an estimated saving of £5000 a year, are being ordered for the Belfast Gas-Works. The new plant will purify three million c.ft. of gas per day, and it is expected that they will be in operation next winter. Meanwhile the renewal of the existing purifiers will occupy a period of four years.

Mr. R. J. Milbourne, J.P., the Managing Director of C. & W. Walker, Ltd., presided recently at the annual distribution of certificates and prizes to the students of the Walker College, near Oakengates, Shropshire, of which he is Chairman of the Governors. Technical training and efficiency, said Mr. Milbourne in the course of his address, are all-important if our nation is to maintain and extend its hold upon the markets of the world.

So Great Has Been the Success of the "all-gas" demonstration house at 71, King's Drive, Bishopston, Bristol, referred to in the "JOURNAL" last week, that it has been decided to extend the period for public inspection until Feb. 14. Thousands of interested householders have already visited the exhibit, not only from the Bristol district but also from surrounding towns. Many parties of senior girls from the schools are visiting the house, as this is a unique opportunity of practical demonstration to domestic science students of the the equipment of the modern home with labour-saving gas appliances.

A Meeting of the Institution of Welding Engineers will be held at the Institution of Mechanical Engineers, Storey's Gate, St. James's Park, S.W. 1 (by kind permission of the Council of that Institution), on Thursday, Feb. 12, 1931, at 7.45 p.m., when the name of the winner of the Operative Welders Prize Competition, 1930, will be declared, followed by the awarding of the Prize and Gold Medal to the winner and a Certificate and Silver Medal to those whose papers are highly commended. The winner will then read his paper, "Welding Practices and Methods Based on my own Experiences," which will be illustrated by lantern slides, to be followed by an informal discussion. Free admission to the meeting can be obtained by ticket from the Acting Secretary, the Institution of Welding Engineers, 30, Red Lion Square, W.C. 1.

A Contribution of £11,430 from the profits of the Belfast Gas Undertaking has been decided upon by the Belfast Gas Committee to pay interest and sinking fund charges on the City Hall. It has been the practice for many years to hand over a similar sum for the same purpose, and altogether a sum approximating £317,000 has been given by the Gas Department towards this purpose.

Metropolitan Gas Company of Melbourne.—We are informed by Messrs. John Terry & Co., of Walmar House, 269, Regent Street, W. 1, that they have received a telegram from their principals, the Metropolitan Gas Company of Melbourne, stating that the net profits of the Company for the six months to Dec. 31, 1930, were £135,380; a dividend of 6s. 6d. per share has been declared; an amount of £50,000 has been transferred to reserve account, and a sum of £43,460 has been carried forward.

A Satisfactory Year's Work is reported by the Directors of Messrs. Ewart & Son, Ltd., of Euston Road, N.W. 1. Notwithstanding the general adverse trading conditions and the many difficulties that have had to be faced in the past year, the trading of the Company has been fairly well maintained, and the profit earned, after making full provision for all bad and doubtful debts and contingencies, amounts, as available for distribution, to £38,222. To this has to be added £20,927 brought forward from the previous year, making a total of £59,149. The Directors recommend that the payment of the preference dividend of 16 p.ct. for the year and the interim dividend of 16 p.ct. on the ordinary shares be confirmed, and that a final dividend of 20 p.ct. on the ordinary shares be declared and paid, making the ordinary dividend 36 p.ct. for the year (less income tax).

Joint Gas Conference at the Fair.

Official Programme.

Following upon the preliminary programme of the Joint Gas Conference, which is to be held at the British Industries Fair, Castle Bromwich, on Tuesday, Wednesday, and Thursday, Feb. 24, 25, and 26, given in the "JOURNAL" for Jan. 7, we are now able to publish below the full official programme of the proceedings covering the three days.

TUESDAY, FEB. 24.

10.15 a.m. Assemble in the Conference Hall, British Industries Fair, when the chair will be taken by Sir Arthur Duckham, G.B.E., K.C.B., M.Inst.C.E., M.Inst.Gas E.
Official welcome to Members by the Lord Mayor of Birmingham, Alderman W. W. Saunders, J.P., and the President of the Birmingham Chamber of Commerce, John Belliss, Esq., M.I.Mech.E.
Reply by Sir Arthur Duckham, President of the Conference.

11. 0 a.m. Presidential Address by Sir Arthur Duckham, G.B.E., K.C.B., M.Inst.C.E., M.Inst.Gas E.

1. 0 p.m. Official Gas Industry Luncheon in the Boulton Room (in the same building as the Conference Hall). Tickets for this luncheon at 5s. per head, exclusive of wines and cigars, should be obtained in advance from the Hon. Secretary.

Afternoon. Inspection of exhibits at the Fair.

WEDNESDAY, FEB. 25.

10.15 a.m. Chairman, Sir Arthur Duckham, G.B.E., K.C.B., M.Inst.C.E., M.Inst.Gas E., supported by Harold E. Copp, Esq., M.Inst.C.E., M.Inst.Gas E., President of the Institution of Gas Engineers. Conference Hall, British Industries Fair.

10.30 a.m. Address by Dr. C. H. Lander, C.B.E., M.Inst.C.E., Hon. M.Inst.Gas E., on "The Gas Industry and Its Relation to the Fuel Problems of Great Britain."

1. 0 p.m. Luncheon in the Bradford Dining Room (adjoining the Conference Hall) by invitation of the Fair Management Committee. Tickets of admission may be obtained from the Hon. Secretary. As the accommodation is limited early application should be made.

Afternoon. Inspection of exhibits at the Fair.

THURSDAY, FEB. 26.

10.15 a.m. Chairman, Sir Arthur Duckham, G.B.E., K.C.B., M.Inst.C.E., M.Inst.Gas E., supported by John E. Daw, Esq., J.P., President of the British Commercial Gas Association. Conference Hall, British Industries Fair.

10.30 a.m. Address by Sir Francis Goodenough, C.B.E., M.Inst.Gas E., on "The Principles of Salesmanship."

No special arrangements are being made for luncheon. The Conference will terminate officially at about 1 p.m., so that those members who wish to visit the Fair in the afternoon shall be free to do so.

TRANSPORT TO AND FROM THE FAIR.

'Buses will leave the Chamber of Commerce, New Street, Birmingham, every few minutes for the Fair, and in addition a special service of trains will be run from New Street Station to Castle Bromwich Station, which adjoins the Fair.

ENGINEERS' CLUB.

Members attending the Conference are invited to accept the hospitality of the Engineers' Club, Waterloo Street, Birmingham. They will become Honorary Members for the period of their stay and will receive a card on application at the Club.

Cornish Association of Gas Managers.

Annual Meeting.

The annual meeting of the Cornish Association of Gas Managers was held at Truro on Wednesday, Jan. 28—Mr. H. H. Hoare, of Falmouth, being re-elected President, and Mr. F. G. Kingwell, Hon. Secretary, for a further term.

Mr. W. H. Sainsbury, Secretary to the Truro Gas Company, read a paper on the two-part tariff method of charge for gas, and gave an explanation of rebates on the block system introduced by his Company.

It was decided to form a Committee for the Cornish Salesmen's Circle as follows:

Four members to be elected from the salesmen and four members as follows from the Association: Messrs. F. R. G. Grant (St. Ives), W. J. Couch (Camborne), R. Morton (St. Austell), and the Hon. Secretary.

Report of the Directors of the Gas Light and Coke Company.

The following is the report of the Directors for the year 1930 which will be submitted at the general meeting of the Gas Light and Coke Company on Friday next.

The accounts for the year show that, after paying in respect of the June half-year dividends at the rate of £4 p.ct. per annum on the 4 p.ct. preference stock, £3 10s. p.ct. per annum on the 3½ p.ct. maximum stock, and £5 12s. p.ct. per annum on the ordinary stock; and, after contributing the sum of £20,000 to the redemption fund, there is a total available balance of £804,134 2s. 6d. out of which the Directors recommend the payment of the following dividends in respect of the December half-year—viz., on the 4 p.ct. preference stock at the rate of £4 p.ct. per annum; on the 3½ p.ct. maximum stock at the rate of £3 10s. p.ct. per annum; and on the ordinary stock at the rate of £5 12s. p.ct. per annum; which, together with the further sum of £20,000 to be contributed to the redemption fund, will absorb £682,078 14s. 11d. and leave £122,055 7s. 7d. to be carried forward to the credit of the current year.

The sale of gas during the past year shows a decrease of 2½ p.ct. There was a satisfactory increase in the sale of gas during the second half of the year, although it was not sufficient to make up for the decrease which occurred during the earlier half of the year, due to the exceptionally mild winter and spring. There has been an addition for the year to the number of the Company's consumers of 25,617, and an increase of 90,382 in the number of gas stoves sold and let out on hire.

A Bill in Parliament has been deposited to provide for the transfer to the Company of the Undertakings of the Southend-on-Sea and District Gas Company and the Brentwood Gas Company, to confer various powers upon the Company and for other purposes. Among the various powers which are sought to be conferred upon the Company by the Bill is included the introduction of the principle of the basic price and dividend in place of the existing standard price and dividend. The clauses of the Bill will be explained to the proprietors, when, in compliance with standing orders, it is submitted for their approval at an extraordinary general meeting which will be held immediately after the close of the ordinary general meeting on Feb. 6.

The Company made an issue of £2,500,000 4½ p.ct. redeemable debenture stock in the autumn, for which there was a very large application. The final instalment not being due until the commencement of the current year, the issue will be dealt with in the capital figures appearing in that year's accounts.

DAVID MILNE-WATSON,
Governor.

Report of the Directors of the South Metropolitan Gas Company.

The following is the Directors' report for the year ended Dec. 31, 1930, which is to be presented at the general meeting of the South Metropolitan Gas Company to-day (Feb. 4).

Notwithstanding an increase in the number of consumers, there has been a slight decrease in the past year's consumption of gas owing to the comparative mildness of the weather experienced in the early months of the year. The gas not accounted for is now below 1 p.ct. Good progress has been made in the improved lighting of main thoroughfares in South London, and the choice of high-pressure gas for this purpose by the Municipalities concerned has been generally approved.

The market for coke has continued firm, but that for tar

THE NEWS—*continued.*

and ammonia has been less satisfactory, owing to further reductions in selling prices. After 14 months' trial, one of the low-temperature carbonizing plants has been shut down owing to mechanical troubles preventing the promoters fulfilling their guarantees. It is expected that the installation erected under agreement with Low Temperature Carbonisation, Ltd., will be shortly put into operation. An issue of £1,000,000 redeemable debenture stock was made in July. Part of the proceeds has been applied in releasing for investment in Government securities the superannuation and other funds which were being used for capital purposes. The working arrangement with the Commercial Gas Company sanctioned by the proprietors at their last meeting is now completed and, in accordance therewith, Mr. Stanley Hunter Jones has been nominated as that Company's representative on the Board of Directors. Preference stock of the Company to the value of £635,812 has been exchanged under the terms of the agreement for ordinary stock of the Commercial Company.

It is proposed to declare a dividend at the rate of 6¼ p.ct. per annum, less the interim dividend of 2½ p.ct. paid in September last, and to strengthen the special purposes fund by the addition thereto of £40,000.

A comparison between the United States of America and this country is so often made in regard to the consumption of electricity that it should be pointed out that in the former country the suppliers of electric and of gaseous energy have been left to compete for business as commercial undertakings, existing for the general weal and without discouragement of either by the Government. In this country, on the other hand, the Minister of Transport has seen fit to throw the weight of his influence into the scale on the side of the interests of electricity, and therefore to that extent to the detriment of gas. It is obvious that the arbitrary displacement and compulsory exclusion of gas in favour of electricity must involve a definite loss of business to the gas undertaking. An industry which for more than a century has fulfilled, and is fulfilling, a great purpose in the economic utilization of the country's coal resources, which in London alone gives employment to some thirty thousand persons, excluding those employed in ancillary undertakings, and which continued to function unaided when electric power stations had to be manned by naval ratings during the General Strike, surely deserves better recognition from the Government responsible for the health and welfare of the country.

Two Directors, Mr. Benjamin Robert Green and Dr. Edward Frankland Armstrong, F.R.S., and one auditor, Mr. John H. Fry, retire by rotation, and, being eligible, offer themselves for re-election. The co-partners have elected Mr. Vernon Hewes as employee Director in place of Mr. Walter A. S. Theobald.

CHARLES CARPENTER,
President.

British Coal Sold at Below Cost Price.

Dr. Lessing on Coal Cleaning.

Twenty-five to 30 p.ct. of the present total output of coal from British pits is sold below cost price. Constructive remedies for this appalling state of affairs were put forward on Jan. 23 by Dr. R. Lessing, F.I.C., M.I.Chem.E., F.Inst.F., at a joint meeting of the South Wales Section of the Society of Chemical Industry, the Institute of Chemistry, and the University College of Swansea Chemical Society, on "Recent Developments in Coal Cleaning."

He pointed out the fundamental economic importance of this subject and regretted that so little attention had been given to it. By its means the value of slacks or duffs, which is at present lower than the general cost of production, could be raised to an economic level, steam coals could be used more efficiently, coking coals could be made to give harder and more uniform coke, and the throughput of gas-works plant and coke ovens could be materially increased.

The object of his paper was to show that the technical solution of the coal cleaning problem had been solved. While water washing and pneumatic cleaning methods depended too much in their action upon the size-weight ratio of particles and consequently were not very efficient and caused much waste, the "float-and-sink" method using a calcium chloride solution depended on specific gravity alone, and therefore gave far better results.

For steam raising careful calculations on the economic side of the question had proved that, after allowing for the full costs of cleaning, including capital charges on the cleaning plant, and for the loss of tonnage by discarding the refuse, the use of clean coal actually resulted in a saving of 1s. 8d. per ton in the case of powdered fuel firing and 1s. 4d. in the case of mechanical stoking. Advantages in the carbonizing of clean coal were even more apparent. It had to be remembered that the equivalent of the carbonizing capacity of the Gas Light and Coke Company was required to deal with the ash content of coals carbonized in British gas-works at present. Further the times of coking could be very materially reduced with clean coals, and this led to increased throughput and fuel economy.

Gas Industry Refused a Hearing.

During a conference of representatives of electricity supply undertakings in Yorkshire and North-East England, held in Leeds on Jan. 26, when Mr. Herbert Morrison (Minister of Transport) was urging supply undertakings to initiate development and adopt all means of increasing the use of electricity, Mr. J. E. Lister Cooper, District Secretary to the National Gas Council, rose to speak on behalf of the Gas Industry.

The meeting, however, intimated that it did not wish to hear him. The Chairman (Dr. A. Hawkyard, Lord Mayor of Leeds) said that Mr. Lister Cooper could put a question if he wished, but he did not take advantage of this.

Mr. Morrison, in reference to the incident, said he was not opposed to the gas industry, and it was to the credit of the industry that in spite of severe competition it had proved itself very adaptable, thereby setting an example to other industries. He was the Minister responsible to Parliament for electricity, and in that capacity he came to this meeting.

At the conclusion of its report of the Conference, the "Yorkshire Post" stated that "Mr. Cooper desired to protest against the Minister 'boosting' electricity, much to the detriment of public utility services which employed a far larger number of men. The Government had spent millions on electricity, but when the gas industry asked for an Act of Parliament to give them more freedom there was nothing doing."

Hampering the Gas Industry.

In a letter published in the "Yorkshire Post" of Jan. 29, Mr. D. A. Pratt, of Holgate Road, York, referred to the letter of Mr. S. S. Ogilvie, Joint Manager of the National Gas Council, appearing in our correspondence columns today (which appeared in the "Yorkshire Post" on Jan. 28), and also to the incident, recounted above, of Mr. Lister Cooper being refused a hearing at the Electricity Conference in Leeds which Mr. Herbert Morrison (Minister of Transport) attended. Mr. Pratt's communication was to the following effect:

The letter from Mr. S. S. Ogilvie, of the National Gas Council, will no doubt have surprised many who are unacquainted with the difficulties with which the gas industry is contending. The Government and a large number of municipalities have undoubtedly declared war on the gas industry, and unfortunately their methods are not above reproach.

Is there any sound reason why gas and electricity should not be on the same footing in straightforward competition? Can any fair-minded person agree with the action of the Government in throwing their resources on the side of the electrical industry? At the present time the Minister of Transport, Mr. Morrison, is stumping the country on behalf of electricity. Bear in mind that the gas industry provides work for 113,000 employees practically all in permanent employment. Then there are other industries directly connected with the manufacture of gas—viz., collieries, tar distilleries, dye and chemical works, including benzole, &c. Why, then, this onslaught from the Government?

I admire the courage of Mr. J. E. Lister Cooper, in rising to protest against the Minister of Transport boosting electricity to the detriment of gas at the meeting at Leeds, when the Minister met representatives of electricity supply undertakings and urged them all "to adopt all means of increasing the use of electricity." It is significant that they refused him a hearing. Mr. Morrison said he was not opposed to the gas industry, but his actions belie that statement. It is amazing that the Government and certain municipalities should adopt selling methods for electricity which in private business would be considered reprehensible. What would Mr. Herbert Morrison and his Government colleagues have to say if property owners engaged in certain businesses only accepted tenants on condition that they traded with them exclusively? It is time the public were made aware of the insidious opposition with which the gas industry is being faced, and the unfairness of the methods employed against it. Nevertheless, the gas industry is going rapidly ahead, which is a sure sign that it retains its popularity with the public.

Is it not time a halt was called and the gas industry put on the same footing as electricity, or, to use a Yorkshire saying, "Let both tubs stand on their own bottom." If

electricity cannot progress without spoon-feeding from the Government, in fact, if it cannot hold its own in open competition, why should public money be wasted on a "white elephant?" Gas has proved, after more than a century of public service, that it is still right at the front and needs no "propping up."

Mr. Lister Cooper Explains the Situation.

The following letter by Mr. J. E. Lister Cooper to the "Yorkshire Post" further explains the incident referred to above:

At a meeting addressed by the Minister of Transport in the Philosophical Hall, Leeds, I wished to make a protest against a Minister of the Crown using his authority as a Minister to "boost" a particular public utility industry to the detriment of another and far larger public utility industry which is performing the same services.

Unfortunately, the Lord Mayor, who initiated the proceedings, was obliged to leave the meeting early, and the chair was then taken by a Labour councillor, Mr. R. Tortington. Labour members have always been loud in their demands for free speech, but evidently that is not meant to apply to those holding opposite views, for apparently Mr. Tortington is prepared to stifle them. I submit that I had a right to speak, considering that matters were under discussion which involved the spending of public money, and speeches made with the object of influencing public policy on such matters as "de-rating," from the benefits of which the gas industry is also debarred.

The Minister of Transport urged the electricity undertakings to adopt favourable two-part tariffs. This is just what the gas industry is desirous of doing, but is prevented from doing by antiquated restrictive legislation. What is sauce for the goose is sauce for the gander. Let Mr. Morrison urge his Government to remove the shackles from the gas industry, and it will do far more to set the wheels of industry going than the "Will o' the wisp" he is now trying to catch.

Mr. A. M. Paddon Addresses Lea Bridge Co-Partners.

The Fourth Co-Partnership Dinner of the Lea Bridge District Gas Company was held on Tuesday, Jan. 20, and was attended by 470 persons, including the officials and employees of the Company with their wives and friends.

Mr. A. M. Paddon, M.Inst.C.E. (Chairman of the Company), presided, and was supported by Messrs. F. W. Cross, S. Jones, W. G. Carey (Directors), Mr. D. C. Cross (Engineer and Manager), Mr. H. Hand (Secretary), Mr. W. T. Kenshole (Chief Assistant Engineer), and others.

The report showed that after eight years of co-partnership, on Dec. 31, the fund stood at £19,321, and the co-partners' savings at £1786, making a total of £21,107. Stock held by 262 co-partners is valued at £16,426.

Mr. Paddon, in proposing the toast of "Success to Our Co-partnership," said that as they looked round upon conditions to-day he thought they would have to adopt the words of the broadcaster when he said that a deep depression was passing definitely over the whole of the British Isles, because industrially speaking that was the case. It therefore behoved them to congratulate themselves on the success with which the co-partnership movement had secured peace, quietude and contentment in their particular industry as contracted with almost every form of industrial enterprise outside themselves. He had had experience of industrial matters for 50 years, and to-day the only spot of light in all the darkness was in the gas industry. Perhaps that was not inappropriate.

Theirs was a highly competitive business, continued Mr. Paddon. They had no form of monopoly. They supplied a great public necessity in response to a public demand, and so long as they supplied that demand they could hope to be successful, and did not mind being in competition with those, who like themselves, were meeting a public requirement.

There was no necessity for any competition between electricity and gas, said Mr. Paddon. Each can do certain things excellently, and each fails in certain regards, but when we find the Government entering into this competitive arena and supporting electricity, subsidizing electricity by capital, helping it by laws, and doing everything they possibly can to help, advance, and develop electricity for purposes for which it is not required, then we as a great public undertaking have every right to complain.

Mr. D. C. Cross later in the evening asked the audience to thank the Chairman and Directors for the enjoyable evening they had spent, and afterwards Mrs. F. W. Cross presented the various sports cups.

THE NEWS—continued.

Official Partiality.

A Co-Partner's Protest.

The following letter to the Editor of the "Daily Telegraph" appeared in the issue of that paper for Jan. 28, written by an anonymous co-partner in the Gas Light and Coke Company:

I am one of 20,000 employees of the Gas Light and Coke Company who by reason of the co-partnership scheme own over £800,000 worth of Company's stock, and I feel it my bounden duty to protest against the partiality shown by the Government and the L.C.C. for the electricity undertakings and their prejudice against the gas industry.

Other interests such as coal and railways receive considerate treatment, but in the case of gas the governing bodies go out of their way to disparage its use.

Tenants of Council estates have had to petition to have gas installed for cooking and heating in preference to the electrical apparatus which had been supplied, and now we hear that Paddington Council have decided to light Bayswater by electricity, even though it has been proved that for highway lighting gas is the superior illuminant.

I am writing as a working man and ratepayer, asking for fair play for an old and important industry.

The Forthcoming Ideal Home Exhibition.

The "Daily Mail" Ideal Home Exhibition is to be held at Olympia from April 7 until May 2, and a most striking brochure giving advance information of the Exhibition and of its principal features has just been published.

The purpose of this brochure is to acquaint exhibitors and others interested with the general layout and special features of the Exhibition, in order that they may catch the spirit of the effort which is being made to produce, next spring, an Ideal Home Exhibition which will, as a whole, provide the most impressive spectacle, and, in detail, the most inspiring displays of homecraft ever seen in this country.

Vividly illustrated in colour, the brochure sets out to convey impressions of various aspects of the Exhibition, most striking of which is the great display in the Grand Hall, which represents the City of the Future, showing that dynamic spirit in the modern trend, which, in the future, may well find some such varying expression as this feature will illustrate.

As usual, gas will play its full part in this ever popular annual Exhibition.

Westminster City Council and Gas Light and Coke Company's Bill.

The Law and Parliamentary Committee of the Westminster City Council reported at the last meeting of the Council that they had had before them the Gas Light and Coke Company's Bill, and had considered particularly Part III., which proposed to repeal the existing provisions dealing with the price of gas and the application of profits, and to substitute a basic price system.

It appeared to the Committee that it would be to the interest of the stockholders for the price of gas to be kept as low as possible, but under the provisions of the Bill the dividends on ordinary stock would not be less than the basic rate of 5 p.ct., even though the price of gas to the consumer were higher than the basic price. The City Comptroller had reported that the application of the provisions of the Bill to the latest available accounts of the Company (for the year ended Dec. 31, 1929) indicated that if the Company had allowed for the carry forward to the next year's account of an amount equal to the balance actually provided, the dividend declared of £5 12s. p.ct. could not have been increased. This dividend, however, based on the sliding scale, was £1 12s. more than the old standard rate of 4 p.ct., by reason of the fact that gas by meter was supplied at the rate of 8·6d. per therm as against the standard price of 11·4d. per therm. If the clauses of the Bill had been in operation, and the gas had been supplied at 9d. per therm, assuming the consumption to be the same, a dividend of nearly 6 p.ct. could have been declared. In other words, whereas under the sliding scale it required gas to be sold at 8·6d. a therm to allow a dividend of £5 12s. p.ct., under the clauses of the Bill the price could be raised to 9d. a therm and allow the dividend to be increased to nearly 6 p.ct. The City Comptroller was of opinion that the interest of the consumer would probably be protected if the sum of 10d. per therm were substituted for the sum of 11d. per therm as the "basic price" of gas.

The Committee reported that the Parliamentary Agents for the Gas Light and Coke Company had stated, in reply

THE NEWS—*continued.*

to a communication addressed to them by the Town Clerk, that the South Metropolitan Gas Company was the first of the Metropolitan Companies to adopt the basic price system which was authorized by its Acts of 1920 and 1925. The same principle had since been adopted in the Commercial Gas Act, 1927, and the South Suburban Gas Act, 1928, and also in the Romford Gas Act, 1929, and the Newcastle-upon-Tyne and Gateshead Gas Act, 1929. The Agents pointed out, however, that the Bill now being promoted by the Gas Light and Coke Company differed from all the precedents in that it proposed to distribute one-sixth instead of one-third of the net ascertained profit between the ordinary stockholders and the employees. The Committee understood that the London County Council—the local authority in London empowered by statute to make representations to the Board of Trade on questions relating to the price of gas—were in negotiation with the Company with a view to the amendment of the Bill to protect the interests of the consumers of gas. The Committee had therefore authorized the Town Clerk and the City Comptroller to confer with the County Council with a view to their pressing for the Bill to be amended on the lines suggested by the City Comptroller. The Committee's report was received and adopted without discussion.

Use of Electricity Enforced on Scarborough Tenants.

Another case of the victimization of tenants of council houses has occurred at Scarborough. The Scarborough Town Council in committee has decided that tenants of the Corporation houses on the Seamer Road Estate must use electric light (supplied by the Corporation Electricity Undertaking) or else relinquish their tenancy. Where tenants have installed gas fittings without the consent of the Council, these fittings must be removed, and any alterations in their connection made good or the tenants must leave.

The Council's reason for this step is that they consider the houses are adequately served by the present electric service.

Co-Partnership Entertainments at Hastings.

This year the social for the adult co-partners of the Hastings and St. Leonards Gas Company was held in two parts to give an opportunity for all to attend. Both on Monday, Jan. 12, and Monday, Jan. 19, the Hastings Pier was the rendezvous, and about 120 attended on each occasion. The entertainment was greatly appreciated, and dancing brought each evening to an enjoyable conclusion.

On Jan. 12, the Chairman of the Company (Mr. J. Macer-Wright, J.P.), was able to attend together with Mr. Apel and Mr. Lockey (Directors). On Jan. 19, Mr. Apel (Chairman of the Co-partnership Committee) presided, Mr. J. Macer-Wright and other Directors being unavoidably absent.

Instead of the usual party this year, the children of the Co-partners with some parents were entertained at the theatre on New Year's Day to the number of 122, and afterwards had tea at Cox's Restaurant. Mr. Botley, the Secretary of the scheme, and other Co-partner members of his staff, acted as hosts on this occasion.

Co-Operation with Builders and Architects.

Mr. W. M. Mason, Manager of the British Commercial Gas Association, speaking on Jan. 29 at a special gathering of architects and builders at the Edinburgh Housing Exhibition, referred to the increasingly valuable co-operation of the gas industry with architects and builders in finding practical solutions to modern building problems.

Obviously, no wise architect or builder was going to risk his reputation by arranging for obsolete methods of lighting, heating, cooking, and ventilating in connection with new housing proposals. It was possible, however, to mar a fine building—as judged from a purely architectural standpoint—because of some inadequate provision for what might be regarded by some as minor considerations, but which in reality were essentials to the health, convenience, comfort, and economy of the whole proposition.

Builders were planning at the outset for the installation of gas apparatus, and were saving substantially in costs. Tenants and owners of new buildings were reaping the benefits of a new comfort, convenience, and cleanliness, and were saving enormously in labour by making fuller use of gaseous fuel. Existing houses were being re-equipped in response to the same demand for those conveniences and for the new and easier reign of order in the home.

The new Chrysler Building in New York, said Mr. Mason—the highest building in the world—had huge restaurants on the seventy-first and sixty-sixth floors, as well as hairdressers' shops, beauty parlours, and other establishments. A 6-in. gas main running up to the seventy-first floor, a height of 777 ft. above the street level, was a notable feature of this latest and most progressive building in New York—a city the scale of whose electrification was often made a reproach to England by the political cant of the shallow type of mind whose loudest assertion was that electricity was synonymous with progress:

Progress.

While gas appliances had long since passed the experimental stage, and had ceased to be "startling novelties," this had not prevented well-sustained—even marked—progress in many directions in their design and efficiency. Taking, for example, the gas cooker. After well over half-a-century of service it had reached a stage of perfection and reliability rivalled by no other cooking agent. Yet it was only during the last few years that such advantages as thermostatic control, all-enamel finishes, and raised ovens had been provided as quite common features. These refinements, it was true, were not yet available in the cheapest types of cooker, but the fact remained that they were available, and that quite a large proportion of the populace could afford the better types of gas appliances, so comparatively inexpensive were they in first cost.

Regarding municipal schemes, where systems of lighting, heating, and cooking equipment were to a great extent standardized, gas was almost universal. The following fact was quoted on the point: In Glasgow housing schemes, out of 34,431 houses, 33,375 (or 97 p.ct.) were equipped for gas cooking, water heating, and room heating.

Mr. Mason, in conclusion, made a plea for the awakening of a public conscience as regards air pollution, and the practical solution to that pressing civic problem lying ready to hand in the gas industry. London, Edinburgh, Glasgow, and every other large city could abolish its smoke pall, increase its sunshine, turn fog into mist, and darkness into light, if it would follow the significant lead of its medical men and of its hospitals and use cleanly smokeless fuels.

Fuel Research Coal Survey.

On Monday, Feb. 2, at the Sir John Cass Technical Institute, Aldgate, E.C. 3, Dr. F. S. Sinnatt, M.B.E., D.Sc., F.I.C., gave an account of the work being carried out by the Coal Survey, which is one item in the programme of work of the Fuel Research Division of the Department of Scientific and Industrial Research.

The Survey is undertaking a systematic investigation of the coal seams of the country, and in order to carry out the work Committees have been appointed in all the major coalfields of the country, and laboratories have been established at convenient centres. The work is now in progress in Scotland, Northumberland and Durham, West Yorkshire, South Yorkshire, North Staffordshire, Nottinghamshire, Derbyshire, and South Wales, while a laboratory is being equipped to serve the coalfields of Warwickshire, Cannock Chase, and South Staffordshire. The work required for the Lancashire and Cheshire coalfields is carried out in the laboratories of the Lancashire and Cheshire Coal Research Association, which has been engaged on research upon coal since 1919. The problems which arise are so diverse that it is necessary to have the laboratories situated in the separate coalfields in order that the staff may be able to visit the collieries whenever necessary.

Upon the technical side the investigations are carried out by obtaining a solid pillar of coal representing the whole thickness of the seam, and transporting this to the laboratory where it may be investigated in detail. In certain cases it is not possible to obtain a complete pillar, but every care is taken that each portion of the seam is represented in the section, and in its correct relative position. In selecting the positions from which the pillar sections are obtained it is necessary to ensure that it is representative of a reasonably large area, and in this part of the work the local Committees give valuable advice. When the pillar section arrives in the laboratory certain parts of the analyses are carried out rapidly so as to prevent changes due to oxidation, &c., and the seam is then examined for its physical characteristics and, if necessary, divided into a number of layers depending upon the character of the seam. Certain seams are so uniform in character that one or two sectional layers only are required, whereas in others it may be necessary to divide the seam into four to six layers. Samples of the various coals are obtained and submitted in the first instance to proximate analysis, together with the estimation of sulphur and the determination of the calorific value. The broad properties of the seam are then reviewed, and after consultation with the staff of the colliery the number of layers which will be examined in

greater detail is decided upon. The seam as a whole, and the various layers, are then examined exhaustively.

In addition to the variation in properties which is found in the different layers in a seam it must be recognized that the seam may vary in properties from area to area, and this change may be a gradual one throughout the coalfield, or may be confined to relatively small areas. It is the object of the survey to trace the variations of the seams throughout the coalfield, and to correlate with this change in properties the possible effect they will have upon the way in which the seam is utilized commercially. A further way in which the seams vary in composition generally is the variation due to the position in the geological stratum. It has been found by Hilt that with increase in the depth of the coal seam there is a tendency for the volatile matter to decrease.

Dr. Sinnatt then discussed a number of examples of the variation which can be encountered in the British coalfields, referring particularly to the Lancashire seams and the Parkgate seam of Yorkshire, reports on which are contained in the series of Survey Papers published by the Fuel Research Division of the Department of Scientific and Industrial Research.

International Conference of Benzole Producers.

A report of the third plenary conference held in Paris on Dec. 12, 1930, is contained in " Journal des Usines à Gaz," 1931, 55, 13-14 (Jan. 5).

M. Laurain presented a general survey of the world situation as regards motor fuels, and additional information covering the situation in their respective countries was given by Messrs. Kurrer (Germany), Petit (Belgium), Mora (Spain), Serville (France), Olliver and Hittinger (Great Britain), Bentz van den Berg (Holland), and Zanen (Sarre).

It was evident that benzole, a motor fuel chosen on its merits, is not liable like petrol to crises arising out of overproduction coupled with under consumption. Such conditions are now prevailing, as regards petrol, throughout the world, particularly in the U.S.A.

It is to be noted that many concerns marketing petrol now add benzole to the petrol to increase its resistance to detonation, though the petrol is not sold as a mixture.

An important communication was presented by Dr. Kurrer on the subject of compression ratios in motor engines, and in the discussion expression was given to the interest which motorists display in the use, within certain limits, of engines with a high compression ratio, since these have an efficiency and flexibility greater than have ordinary engines.

M. Serville referred to the motor races held in France, these having demonstrated the advantages resulting from the use of benzole mixtures. The delegates from Germany and Great Britain supplemented this information with data as to the performance of benzole mixtures in the engines of motors, aeroplanes, and motor-boats.

A lengthy discussion centred round the purity of motor fuels. No agreement was reached as to the tests to be applied, but it certainly seems that the sulphuric acid test should definitely be abandoned. In this connection, reference was made to the work of Hoffert and Claxton (determinations of gums by passage of oxygen). Brunschwig and Jacqué had modified the method by passing air through the heated spirit. A full account of these investigations was presented by M. Brunschwig, and Herr Schmidt stated that the latter method is applicable to petrol and to benzole mixtures, though the old sulphuric acid test is inapplicable. To co-ordinate these investigations the conference decided to appoint a panel composed of specialists from various countries with a view to the issue of a report in June, 1931.

In connection with the refining of benzole, reference was made to the process of the Paris Gas Company invented by Prof. Mailhe and to the process of the Compagnie Générale de Carmaux, both of which dispense with the use of sulphuric acid.

Mr. Adam (Great Britain) gave an account of the theory of the use of inhibitors introduced by the British National Benzole Association. Their use is applicable to petrol as well as to benzole. The licence for the use of inhibitors in the U.S.A. and in Canada has just been acquired by the Standard Oil Company of Indiana.

It was decided to hold the fourth plenary congress at the end of June, 1931, in Germany in a town to be selected later.

Parliamentary Intelligence

[From Our Special Correspondents.]

Private Bills.

The following Private Bills have been presented, read a first time, and referred to the Examiners: Gas Light and Coke Company Bill, Lowestoft Water and Gas Bill; Royston and Brodsworth Gas Bill; the two latter were heard by the Examiners on Feb. 3.

House of Commons.

Private Bills.

The following Private Bills have been read a second time and referred to the Examiners: Aldershot Gas Water and District Lighting Bill; Guildford Gas and Electricity Bill; Sheffield Gas Bill. They were heard by the Examiners on Feb. 3. The South Yorkshire Gas Network Bill has been read a second time and committed.

The South Yorkshire Gas Network Bill, a summary of which appeared in our issue of Jan. 14 (p. 106) is encountering a larger measure of opposition than any other Private Bill now before Parliament. No less than 26 petitions have been presented against it. The Petitioners are: The West Riding County Council; the Corporations of Barnsley, Doncaster, Rotherham, and Sheffield; the Urban District Councils of Cudworth, Goole, Mexborough, Rawmarsh, Wath-upon-Dearne, Hoyland Nether, Wombwell, and Worsborough; the Rural District Council of Rotherham; the Gas Undertakings of Conisborough; Hemsworth, Grimethorpe and District; Sheffield; Penistone and District; Barnsley; Wath, Bolton, and Thurnscoe; South Yorkshire and Derbyshire; Royston and District; the Swinton and Mexborough Gas Board; the Yorkshire Electric Power Company and Electrical Distribution of Yorkshire, the London and North-Eastern Railway Company, the London Midland and Scottish Railway Company; and Messrs. J. & G. Wells.

The Sheffield Gas Bill, which was also summarized in our issue of Jan. 14 (p. 105) is being opposed by fifteen petitioners, including the West Riding County Council, the Corporations of Barnsley, Rotherham, and Sheffield; the Urban District Councils of Hoyland Nether, Wombwell, and Rawmarsh; the Gas Undertakings of Stocksbridge, Barnsley, South Yorkshire and Derbyshire, Royston and District, Swinton and Mexborough, Wath, Bolton, and Thurnscoe; the promoters of the South Yorkshire Gas Network Bill, the Yorkshire Electric Power Company and Electrical Distribution of Yorkshire, and the Blackwell Colliery Company.

The Aldershot Gas Water and District Lighting Bill is being opposed by the Wessex Electricity Company, and the London and Home Counties Joint Electricity Authority. The Guildford Gas and Electricity Bill is being opposed by the Guildford Corporation.

The Gillingham Corporation Bill is opposed by a petition from the Rochester, Chatham, and Gillingham Gas Company; the Southampton Corporation Bill by the Southampton Gas Light and Coke Company, and by the Winchester Water and Gas Company; the Surrey County Council Bill by the Wandsworth, Wimbledon, and Epsom District Gas Company; and the Great Western Railway Bill by the Reading Gas Company.

Legal Intelligence

Compensation Claim Against Worcester Company.

A workman's compensation claim was heard at Worcester County Court last week, when Mrs. Catherine Beatrice Pugh, of 3, Catherine's Vale, London Road, claimed compensation for the death of her husband, Reuben Archie Pugh, who collapsed while unloading coal from a railway truck for the Worcester New Gas Light Company, during the August heat wave of 1930. He collapsed on Aug. 27, and died in the local infirmary the same evening.

Mr. J. F. Bourke, who appeared for the widow, said Aug. 27 was the hottest day of 1930, and Pugh's work was very heavy. Incredible though it might seem, it was a common thing for a man to shovel out of the railway wagons as much as 35 tons of coal a day. About three o'clock in the afternoon Pugh collapsed, became unconscious, and died the same evening. The cause of death was heat stroke.

Thomas Pitt, also of Worcester, who was working in another truck, said that the metal on the side of the trucks was so hot that one could hardly bear to touch it.

Dr. *A. J. Noble*, Senior House Surgeon at Worcester Infirmary, said Pugh did not have the same chance of avoiding heat stroke as members of the ordinary public. Pugh would be more or less under direct exposure to the sun's rays, which were more or less concentrated upon him. More important still, there would be no currents of air. Pugh, working in the four sides of the truck, would be in air which was practically stagnant.

Judge Roope Reeve, giving judgment for the widow for £324, said that he was satisfied that Pugh, by reason of his occupation, was more exposed than other people, and he gave judgment accordingly.

SERVICE AT SMETHWICK

New Showrooms opened by Sir Arthur Duckham.

The opening of the new showrooms which the County Borough of Smethwick Gas Department have erected in High Street, took place on Wednesday of last week, being preceded by a luncheon at the Crocketts Lane Technical Schools, over which the MAYOR (Alderman S. Smith) presided, and at which there were speeches by Sir Arthur Duckham and Sir Francis Goodenough. These showrooms, an illustrated description of which was published in last week's issue of the "JOURNAL," were much admired by the large number of guests who attended the ceremony, and there was ample justification for all the appreciative remarks that were made about them. They are of the type of modern gas showroom which provides a sufficient answer to claims that may be made by any misguided persons as to the superior claims of electrical appliances from the decorative point of view.

During the half-century in which the Corporation have had charge of the gas undertaking its growth, and that of the town, have been rapid, with the result that the Gas Committee (under the Chairmanship of Alderman Williets) and the Engineer and Manager (Mr. E. Hardiker) have charge of a large and flourishing business, backed up by well-designed and efficient gas producing plant. Those who have followed the fortunes of the Smethwick gas undertaking over a long period will also recall the good work that was done for many years, in the positions just named, by Alderman C. W. Pinkney and Mr. Vincent Hughes respectively.

The rapid growth of business to which reference has been made had naturally to be associated with a corresponding increase in the necessary plant for gas manufacture. This development was met in the first place by the installation of regenerative horizontal retorts, a later addition being four beds of inclined retorts. The next development was the installation of a carburetted water gas plant. Further demand necessitated more plant, and a Woodall-Duckham vertical retort plant of 120 tons per day capacity was installed in 1912. Three years afterwards, this vertical retort installation was duplicated. In 1922 there followed a complete reconstruction of the works, which programme embraced the vertical retort installation, which was enlarged from a daily capacity of $2\frac{3}{4}$ millions to $3\frac{1}{2}$ millions.

STRIKING STATISTICS.

Sir ARTHUR DUCKHAM, at the luncheon, proposed the toast of "The Smethwick Gas Department," and referred in the first place to the early association of Smethwick with the gas industry. He went on to remark that the gas undertaking at Smethwick was taken over by the Municipality in 1881. During the last fourteen years the consumption of gas had gone up from 559,000,000 to 888,000,000 c.ft. a year, an increase of approximately 60 p.ct. The consumption of gas per consumer during the same period had increased from 38,196 c.ft. to 46,565 c.ft. The consumption per consumer for London and the suburbs was 26,500 c.ft., and the average for the whole of England was 31,800 c.ft. per consumer. The figure for consumption of gas per mile of main laid in Smethwick was extraordinarily high—over 11,000,000 c.ft. a year—this being the highest in the country, not even excepting Birmingham.

Smethwick being an industrial district, it was only natural that a heavy proportion of the gas consumption should be utilized for industrial processes. During the last year the amount of gas used for industrial purposes reached the astounding total of 40 p.ct. of the gas made, amounting in all to 317,000,000 c.ft. This satisfactorv demand had been built up on the fine services rendered by the Gas Department—in the first place by the low price of gas, with special terms to large consumers; secondly, a constant quality of gas distributed at even pressure; and, thirdly, the technical advice that was always available to actual and prospective consumers.

He had been in close touch with the Smethwick Gas Department for nearly twenty years, and so could speak personally of the splendid spirit that imbued everyone—the Committees, the management, the staff, and personnel. Everyone in the undertaking realized that they were the servants of the public. Smethwick, which was renowned for its public service, was well served in its gas undertaking.

RECOGNITION OF GOOD WORK.

Alderman C. W. PINKNEY, Deputy-Chairman of the Gas Committee, responded to the toast, in the unfortunate absence through indisposition of the Chairman (Alderman Williets). He referred to the time when the Department first came in contact with Sir Arthur's firm, remarking that the advice Sir Arthur gave them at the time proved absolutely correct. He believed they were the first in the Midlands to install vertical retorts at their Rabone Lane Gas-Works, and they had never regretted doing so. Some two years later (in 1913) they more than doubled this plant, with satisfaction to themselves. Then in 1920 the Committee engaged the services of a young man from Bolton. Things had worked exceedingly well for the Borough of Smethwick, so that in 1922 they undertook the absolute reconstruction of the gas-works. This work fell mainly upon the shoulders of the Engineer to whom he had alluded —Mr. E. Hardiker, who was assisted by an excellent staff. Everything that was then promised had been fulfilled, but this fulfilment had demanded great skill and energy. Everything had to be of the best, and they had got it. Referring to the presence of Alderman J. H. Lloyd, Chairman of the Birmingham Corporation Gas Department, he expressed the hope that for many years to come they would see him at their functions. Mr. A. W. Smith, General Manager and Secretary of the Birmingham Gas Department, he said, had been of great help to them. He breathed the spirit of co-operation. Backed up by neighbours of that kind, he did not think there was any cause to fear for the future.

THE GAS INDUSTRY.

The MAYOR next submitted the toast of "The Gas Industry," touching upon its romantic history, and paying homage to the pioneers (including Murdoch) who had done so much for mankind. Researches, he said, were carried out by many. Some attained outstanding achievements, such as Lenoir, who, in 1860, made the first successful gas engine. Let them compare this early type with that of to-day. Lenoir's engine used about 95 c.ft. of gas per horse power per hour, while to-day a gas engine would give 1 horse power per hour for less than 15 c.ft. of gas. It was, however, within the last 30 years that the most rapid improvements had been made to perfect the gas engine, and to these improvements their friend Alderman Pinkney had made notable contributions. The perfection of the gas engine owed much to his genius and ability, and in the years to come his name would be included with those who had made history in the gas industry, and who were not forgotten.

NEED FOR SCIENCE IN SELLING.

Sir FRANCIS GOODENOUGH, responding, congratulated the Smethwick Gas Department upon the new evidence of its enterprise and courage, which was provided by the opening of these very fine showrooms. To-day courage and enterprise were needed throughout the Industry and the whole country. There was too much pessimism, and more of the spirit that was being shown by Smethwick to-day was needed in all directions. The country depended for its progress and prosperity in commerce upon many factors. It was necessary that the spirit of service should inspire all their work. And for this the right personnel was needed. The Smethwick Gas Department was to be congratulated upon having at its head so able and enthusiastic a chief as Mr. Hardiker. In commerce, from the chiefs downwards, a thoroughly capable and trained staff was essential. They required science in selling as much as in production. For securing the right personnel, right education and training were needed, and in this connection it was hoped the British Commercial Gas Association were going to be of further assistance to the gas industry through the Education Scheme which they were shortly launching for the benefit of the commercial side generally. Then if they were going to get and keep the right personnel, there must be adequate salaries. His experience was that industry and commerce had not hitherto attached sufficient value to the commercial side of the business. This they must do if the Nation was to regain and maintain the share of the trade of the world which it used to have, ought to have, could have, and, he believed, would have again.

Another essential factor in success was adequate publicity for the service which industry was able to render to the community. A good showroom was a very fine instrument of publicity, but it was not the only one. The national advertising of the B.C.G.A. was another important factor, but local press and other publicity was also needed, to tell

the consumers all the time all that they were prepared to do for them. It was the bounden duty of any public utility undertaking that had a monopoly of the supply of its commodity in any district to give full publicity to the service it was prepared to render, and so increase its output and reduce its price as far as possible. Those in the gas industry regarded themselves as primarily public servants. He wished the new enterprise of the Smethwick Gas Department the greatest possible success.

After lunch the guests proceeded to the new showrooms, where the Architect, Mr. L. Stanley Crosbie, F.R.I.B.A., presented Sir Arthur Duckham with the ceremonial key, and Sir Arthur declared the premises open.

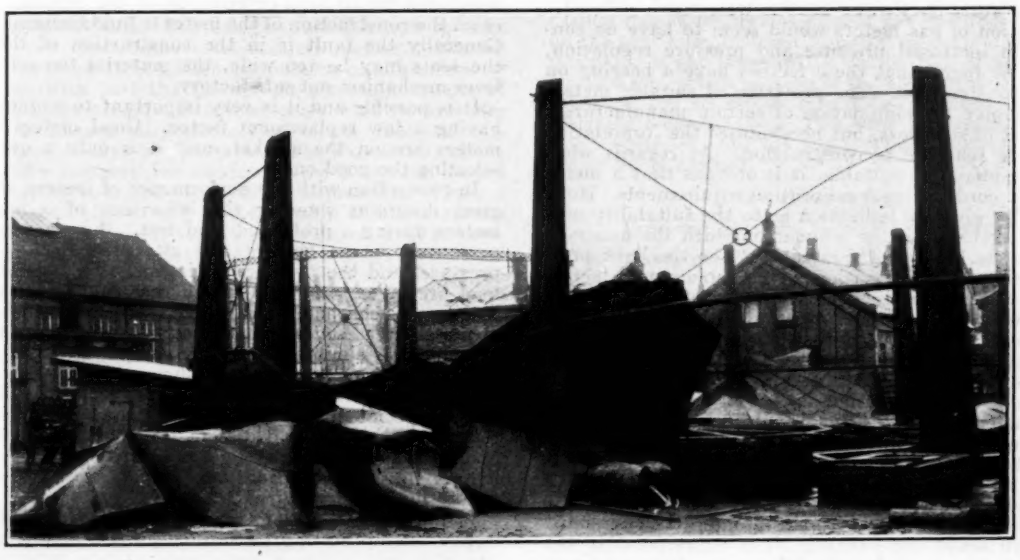
Service to the Consumer.

At the conclusion of these proceedings, Sir Francis Goodenough returned to the Technical College where he addressed the employees of the Smethwick Gas Department's Distribution Section on the subject of "Service to the Consumer." The chair was occupied by Alderman Pinkney.

Sir Francis said that the first principle of commerce was that every business, to be permanently and truly successful, must be conducted on the lines of service to the consumer, with the primary object of making the business mutually profitable to both consumer and buyer. This meant that every transaction must be directed to the end of securing the consumer's complete satisfaction, and so gaining and retaining his permanent confidence. If they got this firmly fixed in their minds they would not go far wrong, and they would secure for the undertaking success which could not by any other means be achieved. People preferred to do business with friends, and it was therefore important to secure the goodwill of those with whom one dealt. This involved a careful and constant study of the customer's needs, and the customer's point of view. The real employer of those present was the customer. The Smethwick Gas Department had no money to pay the employees' salaries, except the money paid to the Department cashier. So that to get their salaries they must satisfy the customers and induce them to use gas for all possible purposes, in this way drawing to the Gas Department as much money as they could get the customers to spend with advantage to themselves, to the benefit of the Department, and the benefit finally of the staff. This thought, if kept in mind, would give them more patience in dealing with difficult consumers. Such consumers, indeed, provided the employee with an opportunity of making friends out of enemies and increasing the business of the Department. Every complaint was in reality an opportunity. In his own Company they tried to make it a rule never to leave a complaint alone until they had both completely cleared the mind of the consumer and obtained an additional order. The treatment of complaints was one of the acid tests of Salesmanship. Those who approached the consumer must be sympathetic, understanding, patient, good tempered, and as nearly angels as might be possible. He hoped that in these few remarks, he had said something which would enable them to help themselves and to help their Department.

Alderman Pinkney, after Sir Francis had been heartily thanked for his address at the call of Mr. Rudge, made a few remarks in which he spoke highly of the work of the manufacturers on behalf of the Industry, and also of the valuable help rendered by the Technical Press, which he advised his hearers to study diligently. He then presented prizes to successful local candidates in the City and Guilds of London Examinations.

Fatal Gasholder Accident in Copenhagen



An accident with fatal results occurred on Jan. 10 at the Western Gas-works, Copenhagen, during the dismantling of a gasholder, the details of which are as follows.

The gas-works, which were built in 1857, had been shut down some years ago, and were partly dismantled. The gasholders only were used as a temporary standby for the supply of the town, until a new gasholder under erection at one of the other gas-works had been put into operation. The Western Gas-Works had eight gasholders in all, four of which have been dismantled during the last few years. The remaining four were in process of demolition.

The gasholders were first so far emptied that they practically reached their bottom position; then the inlet and outlet valves were closed. The inlet and the outlet covers and the top covers were next removed, and water was led to the syphon. The gasholders were then left for aeration for one or two months, after which the dismantling work was commenced. The work in connection with the removal of covers, &c., was carried out under the supervision of one of the engineers of the gas-works.

On Tuesday, Jan. 6, all the remaining holders were put out of operation, and according to the information available, on the Friday morning (Jan. 9) the leading engineer (the same who had been in charge of the dismantling of the previous holders) started a gang of four workmen, whose foreman was a pipelayer, and known as a skilful and conscientious man, upon the work of cutting, plugging, and filling the old piping on the gas-works with water, a work which had to be carried out before the dismantling of the gasholders was commenced. This work would last at least two days, and was of such a nature that it did not demand the continuous supervision of the above-mentioned engineer. For some inexplicable reason the foreman ordered his men to leave this work, and, without any order, directions, or communication to the supervising engineer, commenced to dismantle one of the gasholders on the Friday afternoon. The engineer, who, besides the supervision of the gasholders at the Western Gas-Works, also supervises street work in the town, did not return to the gas-works until Friday evening, and was at this time not advised that the manhole covers of one of the holders had been removed. As he could not possibly suspect that such a thing had taken place, and, on the contrary, knew that the gang had sufficient work in connection with the piping, he did not call again at the gas-works until Saturday noon.

On Saturday morning the foreman and two of the work-

men continued dismantling the next gasholder. This gasholder, which was erected in 1856-57 and had a capacity of about 100,000 c.ft., was an ordinary single-lift holder; its diameter was about 80 ft. The workmen first tried to remove the cover over the inlet and the outlet, and managed to get out about half the bolts; but the foreman must have thought that this work advanced too slowly, and he ordered the men to make a hole of some size around the manhole with a pickaxe. When the sheet had been hewn free and removed, the foreman instructed them to make the hole still larger; at the same time he went up in order to prepare for the removal of the top cover. At this moment the explosion took place, no doubt caused by a spark from a pick. Two men, one of whom was the foreman, were killed; and a third, who was on the edge of the holder, received slight injuries.

As the gasholder itself was to be sold as scrap, the damage was inconsiderable, though there were numerous broken window panes in the neighbourhood. The explosion did not cause any interruption whatever in the gas supply, as the holders had been disconnected from the supply system for some days.

IN CONTINENTAL COUNTRIES - - -

Abstract Translations from the Technical Press of France and Germany.

GAS DISTRIBUTION AND GAS METERS.

A paper on the above subject by B. Ludwig appears in "Das Gas- und Wasserfach," 1930, 73, 1201-1207 (Dec. 20).

As regards distribution, emphasis is laid on the need for constancy of calorific value, specific gravity, and pressure. At Berlin, due to a reduction in the standard calorific value, and an increase in specific gravity, it became necessary to increase the distribution pressure, and, in order to equalize conditions over the district, the whole area of supply was equipped with governors. At the same time, particular care was taken to ensure constancy of calorific value to within ± 5 B.Th.U./c.ft. The question of uniform specific gravity was more difficult, since the gas was supplied from six or seven works, and, in part, from coke ovens. Constancy of gas quality was controlled by use of an Ott gas tester and a uniform Ott number was maintained for the gas. As a result of these measures, a marked increase in gas sales occurred and complaints as to blockages and unsatisfactory working of water-heaters were much reduced.

The question of gas meters would seem to have no connection with increased pressure and pressure regulation, but it will be found that these factors have a bearing on gas meter construction. The provision of suitable meters does not involve the elimination of certain manufacturers from the list of suppliers, but necessitates the formulation of a suitable schedule of construction. As regards what may be considered as suitable, it is obvious that a meter must be in accordance with calibration requirements. However, a badge gives no indication as to the suitability of a meter in actual use, or the manner in which the accuracy alters with the load, or the sensitivity, or the back pressure, or the pressure fluctuation, or the replacement factor. By replacement factor is meant the percentage of meters requiring to be replaced over a period. More must be demanded from a meter than that it should behave in accordance with its test certificate. The meter should conform to its calibration curve within a limit of ± 2 p.ct. even under a high load—that is, the accuracy should be relatively independent of the load. Moreover, the accuracy should show a minimum alteration after a prescribed prolonged test. When success has been attained as regards this stipulation, there will be no need to insist on a periodical checking of meters. The cost of such check tests in Berlin amounts to £100,000 per annum. A meter must show a high sensitivity—that is, it must respond to the passage of but a small fraction of a cubic foot per hour. A well-constructed meter is sensitive to 0·07-0·1 c.ft. per hour, even after a prolonged load test during which as much gas is passed through the meter as would pass through it during 20 years of actual use. Bad meters are insensitive to as great a flow as 1½, 2, or 2½ c.ft. per hour, but may nevertheless be accepted for stamping. This means that a consumer may continuously leave a small flame burning without fear of the consumption being registered. It is astonishing how high a proportion of meters, even new meters and test meters, shows a low sensitivity.

The table analyzes the faults developed within two years in meters supplied by eight firms.

Defects per 100 Faulty Meters, and Percentage of Meters Faulty

Nature of Defect.	Meters Supplied by Firm.							
	1	2	3	4	5	6	7	8
Irregular gas flow . .	18	11	16	8	30	10	40	41
Fails to register, or registers inaccurately	9·5	29	13	14	18	13	17	10
Noisy	21	8	12	3	16	11	13	23
Leaking	42	43	29	28	13	29	17	24
Dial glass broken . .	9·5	1	12	40	18	28	10	1
Coin mechanism stuck	..	8	18	7	5	9	3	1
	100	100	100	100	100	100	100	100
P.Ct. of meters faulty	3·71	10·20	5·28	1·37	5·73	2·36	3·25	3·40

It will be seen that the replacement factor varied between 1·37 and 10·2 p.ct. in the several makes. It has since been ascertained that, in the case of individual makes, up to 39 p.ct. of the meters required changing within two years. The table shows, also, that in the case of the meters supplied by Firm 4, 68 p.ct. of the defects were due to broken dial glasses or leaks, though it would have been readily possible to safeguard against this by the provision of thicker glass and a more robust construction of the inlet and outlet pipes. By way of a further example, it may be pointed out that in the case of meters from Firms 7 and 8, irregularities in the flow of gas and allied defects accounted for 70 p.ct. or upwards of the defects. In such cases the construction of the meter is fundamentally wrong. Generally the fault is in the construction of the slide—the seats may be too wide, the material too soft, or the lever mechanism not satisfactory.

It is possible and it is very important to employ meters having a low replacement factor. Good meters and bad meters are on the market, and it is only a question of selecting the good ones.

In connection with the performance of meters, the paper gives diagrams showing the behaviour of a number of meters during a prolonged load test. Curves showing the percentage error (before and after the test), the back pressure, and the pressure variations as a function of the load are given, and it is stated that each make of meter has its own characteristics which can be defined by means of these three curves. The back pressure curve for nearly all meters is similar, though not identical. The pressure variation curve, however, can show wide differences. The measurement of pressure variations is very difficult and requires special instruments. Variations are caused by resonance due to gas eddies in the conduits of the meter and by pulsations of the gas. In the case of some dry meters, pressure variations may be very wide and may give rise to flickering in burners.

In order that gas may be supplied with maximum efficiency, meters having constant accuracy and a maximum capacity with a small back pressure are required. Wet meters show a constant accuracy but have the drawback that their back-pressure is too high. As regards wet meters, the Brandl-Marischka meter (see "JOURNAL" for Aug. 13, 1930, p. 363) differs from ordinary meters. It is, however, applicable only to large rates of gas flow—namely, consumptions exceeding 1800 c.ft./hour. It is likely to supersede meters of the drum type and is cheaper than these. Its performance is very good.

Slot-meters must be used more widely to meet the needs of the working classes, but their cost is a drawback. Some firms, however, supply slot meters with a coin mechanism detachable from the meter itself and hence capable of being replaced separately. It should be possible to construct, at a cost of 7s. to 8s., a coin unit capable of being easily attached to a meter, and this would be a distinct relief to consumers finding difficulty in meeting their quarterly accounts.

The discussion of the paper centred around the relative merits of slides and valves in dry meters and the use of corrosion resisting metals of adequate hardness. The need for standardized methods of assessing the merits of meters was emphasized.

THE "JOURNAL" TECHNICAL RECORD

Which also contains Full Reports of Meetings of Gas and Allied Associations ———

Incomplete Combustion: Its Importance, Recognition, and Prevention

By E. W. B. Dunning, B.Sc., A.I.C., of the Research and Training Section, Watson House, Gas Light and Coke Company.

[Paper read before the London and Southern District Junior Gas Association at the Westminster Technical Institute on Jan 30—the President, Mr. T. H. Prater (Margate) in the chair. The discussion on this Paper will be reported in next week's "JOURNAL."]

General Considerations—Phenomenon of Combustion.

The burning of substances is a chemical reaction in which the substance combines with the oxygen of the air, and heat is evolved. Air is generally said to be the supporter of combustion; this is only relative, and depends upon whether the substance or the air is outside the flame. It is quite a simple experiment to show that air will burn in an atmosphere of coal gas.

The value of a fuel depends, to a large extent, upon the heat generated when its combustible constituents are burnt with oxygen or air. The principal combustible elements of a fuel are carbon and hydrogen. Carbon dioxide and water are the products of complete combustion, together with nitrogen from the air used for combustion, and sulphur dioxide from the small proportions of sulphur present in most fuels. For complete combustion to take place, the air must come into intimate contact with the fuel. In practice it is seldom possible to obtain complete combustion with just the theoretical air requirements of the fuel, except perhaps in special cases where means are provided to ensure intimate mixing of the fuel and air. The air must always be in excess. The excess air, above that actually required for combustion, will become heated and pass away with the products of combustion. Thus, a certain amount of heat will be lost, and it is advantageous to keep this excess air down to a minimum as long as complete combustion is assured. However, much less useful heat is wasted by having excess air than by having an equal deficiency of air. The more finely divided the fuel, the greater will be the ease and speed of complete combustion. The increased use of pulverized solid, atomized liquid, and gaseous fuels indicates that this is realized more to-day.

Stages in Combustion.

The combustion of gaseous compounds is not always effected in one single reaction, but may be in a series of stages. The speed with which these stages follow one another varies with the method of combustion. In explosions the stages follow one another with great rapidity; the whole series may be complete in 1/1000 of a second. In flames the combustion is slower, and fig. 1 shows the various regions that can be seen in bunsen, luminous gas flames, and candle flame respectively.

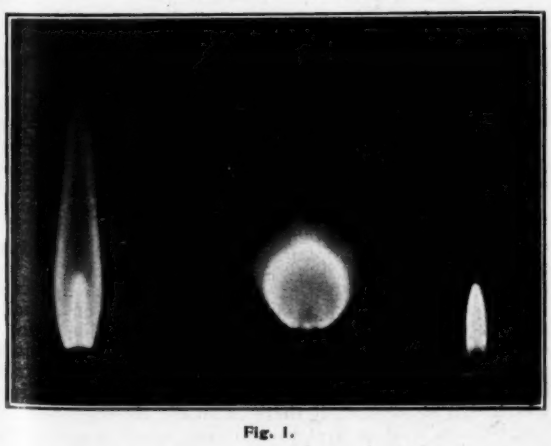


Fig. 1.

Causes of Incomplete Combustion.

If there is not sufficient oxygen for complete combustion the series may stop at one of these stages. If the flame—that is, the mixture of gases at high temperature—is suddenly brought into contact with a cool surface, further combustion cannot proceed even in the presence of oxygen. There are thus two main causes of incomplete combustion—viz., an insufficient supply of air in the right place, and flame chilling. Means of avoiding incomplete combustion are dealt with later in this paper.

It may be as well to state here that variation in the carbon monoxide present in coal gas has little or no effect on the products of combustion, for the formation of carbon monoxide is one stage in the combustion of hydrocarbons. Natural gas, which consists of methane, ethane, and a little nitrogen, but no carbon monoxide, produces the latter on incomplete combustion. This state of incomplete combustion results, as with town gas, from insufficient supply of air or flame chilling.

Importance.

Loss of Heat on Incomplete Combustion.

The quantity of heat evolved during combustion is the same whether the reaction is complete in one stage or slowly in a series of intermediate stages. For example, the amount of heat liberated when one pound of carbon is completely burnt to carbon dioxide is 14,600 B.Th.U. The amount of heat liberated when the same quantity of carbon is burnt to carbon monoxide is 4450 B.Th.U. If the carbon monoxide evolved is burnt to carbon dioxide, a further 10,150 = 14,600 − 4450 B.Th.U. will be liberated. Thus the amount of heat obtained by burning one pound of carbon to carbon dioxide is constant no matter how the combustion is effected. When coal gas is completely burnt the amount of heat obtained is the same whether luminous or bunsen flames are used, and depends solely on the calorific value and amount of gas burnt. When combustion is incomplete, some combustible gases will pass away with the products of combustion. Thus a certain amount of useful heat is wasted. This is of great importance with solid and liquid fuels, but the combustion of gaseous fuels can be more easily controlled, and is seldom so incomplete as materially to affect the thermal efficiency of an appliance. The following table compares the heat lost by incomplete combustion with domestic fires.

Table I.

Fuel.	CO/CO_2 Ratio.	P.Ct. CO in Undiluted Products.	P.Ct. Heat Lost.
Gas (normal) . . .	0·008	0·1	0·3
,, (bad) . . .	0·087	1·0	2·5
Coke (normal) . . .	0·43	12·0	11·0
Coal ,, . . .	0·56	14·0	12·6

Although the incomplete combustion of coal gas has very little effect on the thermal efficiency of gas appliances, yet its physiological aspect is extremely important. In order to appreciate the physiological effect of the products of com-

plete and incomplete combustion, a short account of the mechanism of respiration is necessary.

Respiration.

The body may be considered as an engine, the food consumed being the fuel which is burnt by the oxygen inspired, the expired air being the flue gases from the combustion furnace. The heat generated maintains the body warmth and supplies the energy which enables the machine to do work.

The main respiratory organs in the body are the lungs which consist of openwork membranes similar to a sponge. Blood flows in capillaries through these membranes and oxygen diffuses through the latter into the blood. The oxygen combined in the blood passes through the arteries

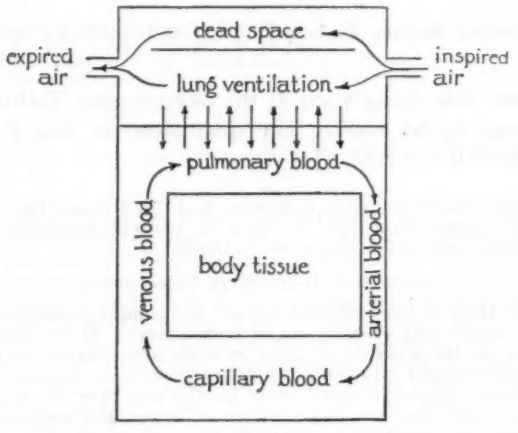


Fig. 2.

to the capillaries in the body, where oxidation of the waste matter takes place. The blood absorbs the carbon dioxide and water vapour produced and passes back through the veins to the lungs, where the carbon dioxide and water vapour pass out and are expired. The process is made continuous by the lungs being alternately expanded and contracted, drawing air into them and expelling the carbon dioxide and water vapour.

Respiration does not draw air directly into contact with the blood, but at each inspiration 10 to 20 cub.in. of fresh air enters the lungs and mixes with the gases already present. The concentration of carbon dioxide in the lungs varies only slightly; normally, about 5·5 p.ct. carbon dioxide and 15 p.ct. oxygen are present.

Normal respiration is governed by the concentration or partial pressure of carbon dioxide in the lungs, which is maintained remarkably constant. The adjustment is so precise that the slightest alteration in the concentration of carbon dioxide causes an increase or decrease in the rate of breathing. This is not, however, due to any specific action of the carbon dioxide, but that carbon dioxide dissolves in the water present in the blood to form an acid; and it is this acidity which plays the important part. Variations in this acidity affect the nerve centres of the brain and vary the rate of breathing.

Physiological Effects of Products of Combustion.

The products of complete combustion of coal gas consist of carbon dioxide, water vapour, and air from which part of the oxygen has been withdrawn, together with traces of sulphur dioxide, oxides of nitrogen, &c.

Carbon Dioxide.

Carbon dioxide is produced by the oxidation of the tissues of the body, and the rate of breathing is controlled by the carbon dioxide present in the lungs. An increase in bodily work causes faster oxidation of the tissues and an increase in the rate of breathing. In the same way breathing of air containing relatively large amounts of carbon dioxide will also increase the rate and depth of breathing.

Until recently, the harmful effects of a vitiated atmosphere were considered to be due to the poisonous action of carbon dioxide and the deficiency of oxygen. This is now entirely disproved. Carbon dioxide is entirely without effect in the concentrations found in the most overcrowded spaces, while oxygen deficiency has no appreciable effect until the percentage concentration is lower than 15 p.ct. Respired air contains a variable and maybe unhealthy concentration of bacteria. It is for this reason that the Factory Act will not allow the carbon dioxide present in the air to exceed 12 parts per 10,000 in the daytime. The carbon dioxide content is easily measurable, and it was assumed that the amount of this gas would be proportional to the expired breath present, and so to the associated danger of bacteriological infection. The fact that the carbon dioxide concentration was controlled, and due possibly also to some confusion with the definitely poisonous character of carbon monoxide, was sufficient to cause some to think that carbon dioxide was poisonous.

Deficiency of Oxygen.

The amount of oxygen present in the outside air remains remarkably constant at 20·9 p.ct., while the carbon dioxide is approximately four parts per 10,000. Combustion causes oxygen to disappear and carbon dioxide to be produced. In the combustion of town's gas the amount of oxygen used is approximately twice the volume of carbon dioxide formed. If the normal diffusion of the air is impeded the amount of carbon dioxide will increase and the oxygen content will fall. It is only under extreme conditions that the deficiency of oxygen has any appreciable effect.

Carbon Monoxide.

A common product of incomplete combustion is carbon monoxide. Fatalities caused by motor exhausts, coke braziers, defective geysers, or gas leaks may all be attributed to this one gas. Carbon monoxide is present in considerable proportions in the exhausts of internal combustion engines (1 to 10 p.ct.).

Carbon monoxide combines with hæmoglobin, the red colouring matter and oxygen-carrying component of the blood. This combination temporarily renders it unable to absorb the oxygen of the air that enters the lungs. Thus the blood is unable to carry its proper supply of oxygen from the lungs to the cells and tissues of the body. As the affinity of carbon monoxide for hæmoglobin, is about 300 times as great as that of oxygen for hæmoglobin, a very small percentage of carbon monoxide in air is highly dangerous.

Henderson has been studying the ventilation of New York traffic tunnels and the effects of low concentrations of carbon monoxide on persons at rest and possibly in a low state of health who may frequent the tunnels. In the confined space of tunnels dangerous amounts of carbon monoxide may accumulate unless adequate ventilation is provided. He investigated very thoroughly the maximum amounts of carbon monoxide allowable in the air with complete comfort and efficiency for one or two hours. Henderson adopted from the result of his researches a general standard. There is, however, a limit to this standard. Any duration beyond about three hours has the same effect as exposure for this time.

Time in Hours × Parts of Carbon Monoxide per 10,000.	Physiological Effect.
3	No perceptible effect
6	Just perceptible
9	Headache and nausea
15	Dangerous to life

Physiological Effect of Vitiated Atmosphere.

In occupied rooms the concentration of carbon dioxide and water vapour will rise, due to the amounts produced by the persons present. Approximately 1 c.ft. of both carbon dioxide and water vapour will be formed by each person per hour, and the oxygen content will decrease by about the same amount. If the room is hermetically sealed there will be 1 c.ft. of carbon dioxide present per person at the end of the first hour, 2 c.ft. at the end of the second hour, and so on. Let us take a particular example, and suppose there are five persons present in a room of 1000 c.ft. capacity. Fig. 3, curve 0, shows the effect of plotting time against the carbon dioxide concentrations. It will be seen that the curve is a straight line.

It is very difficult to seal a room hermetically, and air change will take place. An air change of two—that is, a volume of air equal to twice the capacity of the room introduced every hour—is normal. An air change of one is less than normal, while an air change of a half is definitely bad. We found it difficult to produce so low an air change as a quarter even by blocking up the flue and sealing all the cracks, for air will pass through plaster ceiling. Curve 1 shows the concentration of carbon dioxide which will be present if there is an air change of one. It will be seen that at first there is not much deviation from curve 0, but later it quickly leaves, and approaches a maximum value. It never actually meets this maximum, but after a time approaches very near to it. Curve 2 is formed with an air change of two. It will be seen that the maximum concentration with an air change of one is equal to

the concentration produced after one hour with no ventilation. The maximum with an air change at two is equal to that produced after half-an-hour with no ventilation. The atmosphere will be altered in a similar manner by the combustion of coal gas. Taking G.L.C.C. gas, which produces approximately half a cubic foot of carbon dioxide per cubic foot of gas burnt, 10 c.ft. of gas burnt per hour will produce the same concentration of carbon dioxide as five human beings. Fig. 3 thus also shows the effect of burning 10 c.ft. of gas per hour.

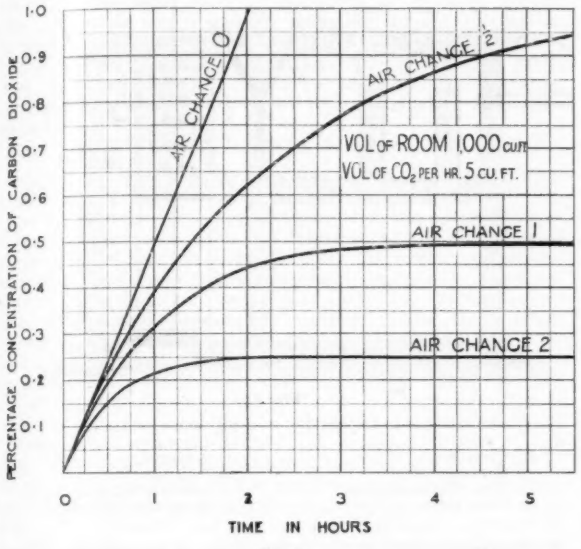


Fig. 3.

Many types of gas appliances are provided with flues, and the products of combustion do not enter the room but pass away up the flue. The flue gases being hot exert a pull and the flue acts as a ventilating shaft and increases the natural ventilation through the room. On the other hand, there are appliances which are not normally used with a flue—for example, radiators, cookers, and low-consumption storage heaters. The concentrations of the various products of incomplete and complete combustion likely to be produced in rooms must be considered in relation to the physiological effects of these products.

The concentrations of carbon monoxide normally found in the flue outlet of gas appliances is very low, in most cases lower than that found in the air of London streets. It may be interesting to compare concentrations issuing from normal gas appliances with that in the air at breathing level.

Source.	Concentration of CO per Million Parts of Air.
Radiator	about 5
Cooker oven	10
Geyser	30
Fire	40
Air at Meadow Lane, Leeds	5
Wandsworth Road, London	50
Vauxhall, London	60
Paris	10–44
New York—	
Average of 141 tests	80

There is more carbon monoxide in the air at traffic centres than in most modern gas appliances of good design. We have found that the air entering a flueless radiator may contain more carbon monoxide than the flue gases leaving it, and then the concentration of carbon monoxide in the air is actually being reduced by the use of a flueless heater.

Although there is but very little danger of carbon monoxide poisoning from well-designed gas appliances, unfortunately, all appliances in use cannot be classed in this category. The importance of good combustion cannot be urged too strongly on both manufacturers and users. Manufacturers cannot be prevented from selling appliances of poor design, and when they have once been purchased the owners are loth to discontinue their use.

Recognition.

Before it is possible to improve the combustion of an appliance a ready method must be available in order to determine the degree of incomplete combustion. The appearance of the flames and the smell of the flue gases, although useful, are too often the only criteria. The characteristic smell of incomplete combustion is not always present even when quite large amounts of carbon monoxide are being formed. It is essential that the flue gases be analyzed in order to determine whether the combustion is complete or not.

The detection and estimation of products of incomplete combustion offers some difficulty owing to the small concentration in which they are present, and special methods must be employed. For example, it is no use trying to estimate the carbon monoxide present in the flue gases of even poorly adjusted gas appliances by absorption in cuprous chloride solution in a Bunte burette or a Bone and Wheeler apparatus.

Estimation of Carbon Dioxide and Oxygen.

The products of complete combustion of coal gas are, as has been emphasized earlier in this paper, carbon dioxide, nitrogen, and water vapour. Excess air will in most cases be present, so that oxygen will also be present in the flue gases. The amount of carbon dioxide which is formed on the complete combustion of a quantity of coal gas can be determined by an analysis of the gas—in a Bone and Wheeler apparatus, for example. If carbon monoxide is formed, there will be less carbon dioxide in the flue gases, and the estimation of carbon dioxide present will give some indication as to whether the combustion is complete.

In fig. 4 is shown the result of plotting the percentage carbon dioxide and oxygen present in the flue gases against the excess air present per volume of gas burnt. It will be seen that the percentage of carbon dioxide is at a maximum when no excess air is present, and gradually falls as the products of combustion are diluted with air. This maximum concentration of carbon dioxide depends on the proportion of constituents present in the coal gas. The remainder of the flue gases consists of the nitrogen present in the gas and in the air used for combustion. As the excess air increases and the percentage of carbon dioxide falls, the percentage of oxygen will rise and tend to get nearer and nearer to 20·9 p.ct., the amount present in the air; the carbon dioxide percentage will also approach that present in the air—*i.e.*, approximately 0·04 p.ct. It may be as well to note that, although the percentage of carbon dioxide falls, the total amount of carbon dioxide produced is constant for any particular gas rate and gas quality if combustion is complete.

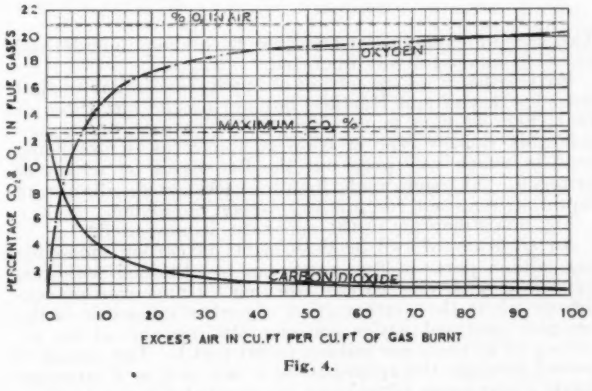


Fig. 4.

If the gas rate of a geyser is increased, the carbon dioxide percentage will increase until a maximum is reached, and then it will decrease owing to the formation of carbon monoxide.

If a graph is plotted, fig. 5, showing the variation of carbon dioxide concentration with gas rate, the point of maximum carbon dioxide is that at which dangerous concentrations of carbon monoxide will begin to form. Unless a series of analyses be made, the determination of carbon dioxide alone is not sufficient; but if the flue gas is also analysed for oxygen the position of the carbon dioxide percentage on the curve is fixed, and more reliable results are obtained. The estimation of carbon dioxide and oxygen, although it gives valuable information, is not sufficient, in most cases. All the air present in the flue gases may not go through the combustion zone. Carbon monoxide may be present although there is plenty of excess air in the flue gases. However, if the carbon dioxide percentage is plotted against gas rate, there will still be a peak, but this maximum will be less than the theoretical maximum and the peak will not be so pronounced. The more the products of combustion are diluted the flatter will be the curve, until, when the maximum is below about

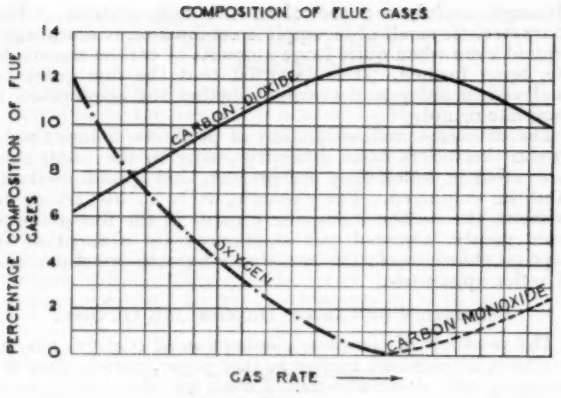


Fig. 5.

10 p.ct., the curve is so flat that it forms no useful guide as to the completeness of combustion.

As has been mentioned earlier, the other factor affecting the completeness of combustion is flame chilling. Now the extent of flame chilling, and consequent production of carbon monoxide, may be independent of gas rate—indeed, the flue gases of some appliances contain more carbon monoxide at low gas rates. The estimation of carbon dioxide and oxygen will thus be no indication of the formation of carbon monoxide by flame chilling. This indirect detection of the products of incomplete combustion must be supplemented by direct determination of carbon monoxide.

Carbon Monoxide.

Carbon monoxide can be determined by burning it to carbon dioxide and estimating the amount of carbon dioxide formed. Easily reduced metallic salts are also used as reagents. The reaction of blood solution with carbon monoxide is used as a basis for several methods of detecting and determining carbon monoxide. All these methods are, however, relatively insensitive compared with that depending upon the reaction between carbon monoxide and iodine pentoxide.

$$\underset{\text{Iodine pentoxide}}{I_2O_5} + \underset{\text{Carbon monoxide}}{5CO} \rightarrow \underset{\text{Iodine}}{I_2} + \underset{\text{Carbon dioxide}}{5CO_2}$$

The carbon monoxide is oxidized to carbon dioxide and iodine is quantitatively liberated.

We originally set up a train of apparatus similar to that used by Davies and Hartley, but during the last three or four years we have made several modifications, and a considerably shorter type of train of apparatus is now being used in which we sweep out the flue gases by means of nitrogen. Nitrogen made by the fractional distillation of liquid air does not contain any carbon monoxide.

Fig. 6 is a diagram of the apparatus as now used.

An accuracy of two or three parts of carbon monoxide per million parts of flue gases can be obtained with this apparatus with very careful working. Under routine conditions where the concentration of carbon monoxide in the samples analysed varies considerably, we aim at an accuracy of 10 parts per million (0·001 p.ct.). The sample is passed through the apparatus at a rate of 2 to 4 litres per hour, a maximum of 10 litres of sample being used. Considerably less than this is used, however, if the concentration of carbon monoxide is above 0·05 p.ct. In practice the sample is stopped and nitrogen passed through, when the potassium iodide solution in (1) begins to turn brown. Nitrogen is passed through for four hours to sweep the flue gases out of the purifying train and over the iodine pentoxide. The complete estimation occupies about six hours.

This method has been modified by Vandaveer, fig. 7, using chromic acid in sulphuric acid in place of the series

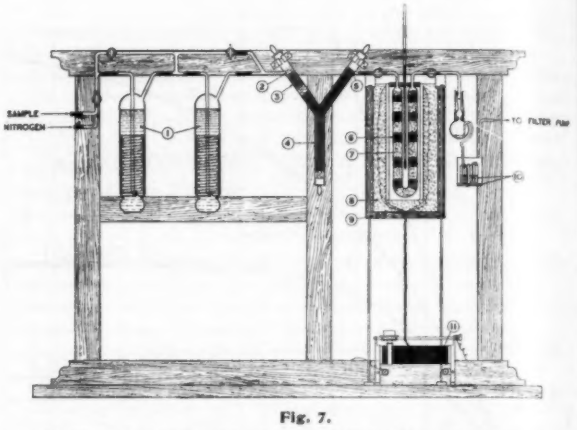


Fig. 7.

(1) Chromic acid in sulphuric acid.
(2) Glass wool.
(3) Caustic soda.
(4) Fine calcium chloride.
(5) Glass wool.
(6) Iodine pentoxide.
(7) Glass wool.
(8) Asbestos.
(9) Hair felt.
(10) Iodine absorption bottle.
(11) Resistance for furnace.

of absorbents used in the other train of apparatus. Three trains of this type are now in use in which a few slight modifications have been made. Vandaveer only used 500 c.c. samples of gas in his apparatus, but we find that, if the usual 5-10 litre samples are passed over the apparatus, the accuracy is equal to that obtained on the larger apparatus and offers many advantages over the former, such as decreased time for analysis (1½ hours) and simpler apparatus, with correspondingly fewer rubber joints. The decreased time is not due to any increased rate of passage of the sample, for a sample rate of 4 litres per hour is still used, but to a greatly decreased volume of nitrogen needed to sweep out the apparatus. The amount of dead space over the absorbents has been greatly reduced in this type of apparatus, and tests have shown that a quarter of an hour is sufficient to sweep practically all the sample through the reaction tube.

We have eight of the long type and three of the short American type of apparatus in use at the present time at Watson House. The latter type gives three times the service of the longer train, and we are shortly adding two more and reducing the number of long trains to two. About ten samples are analysed each day. Of course, this allows a large margin for rush periods.

Physical methods have also been devised for estimating carbon monoxide depending on:

(1) Thermal conductivity of the flue gases.
(2) Catalytic oxidation of carbon monoxide, and measurement of the heat evolved.

The first method, while quite useful for estimating the

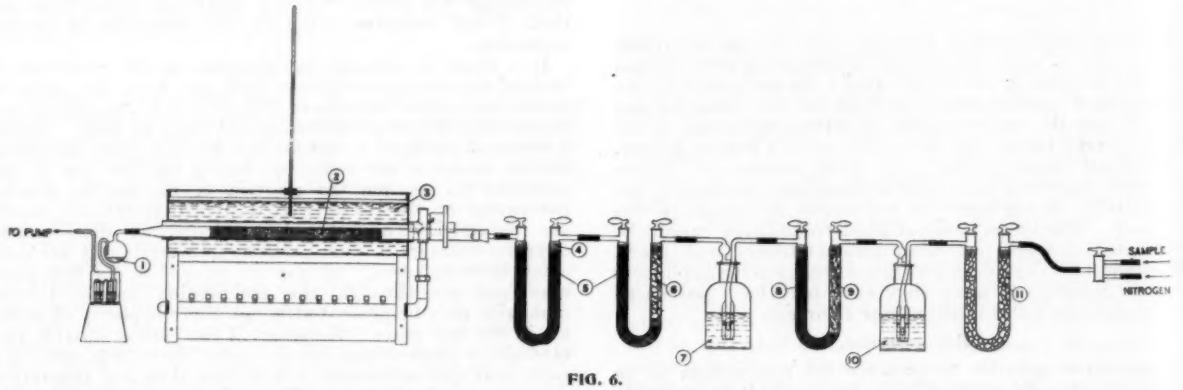


FIG. 6.

(1) Iodine absorption bottle.
(2) Iodine pentoxide.
(3) Oil bath.
(4) Glass wool.
(5) Fine calcium chloride.
(6) Coarse calcium chloride.
(7) Caustic soda solution.
(8) Sofnolite.
(9) Glass wool.
(10) Fuming sulphuric acid.
(11) Coarse calcium chloride.

relatively large concentrations of carbon monoxide present in the flue gases from solid fuel furnaces, is not capable of the extreme sensitivity required in the estimation of carbon monoxide from gas appliances.

The Katz recorder works on the second method. The carbon monoxide is oxidized by Hopcalite (a mixture of copper oxide and manganese dioxide). Thermocouples are embedded in the Hopcalite, and the electrical potential due to the rise in temperature is recorded on a recording potentiometer. The recorder is fully described in the U.S. Bureau of Mines Technical Paper, No. 335. One of these recorders has been recently installed at Watson House. The apparatus was originally designed for the estimation of carbon monoxide in the New York traffic tunnels. The sampling rate was high, approximately 120 c.ft. per hour. This has been reduced to 30 c.ft. per hour on our apparatus, and may be reduced further by using a smaller Hopcalite chamber.

Interpretation of Results.

Carbon monoxide is the only product of incomplete combustion likely to be formed in sufficient quantities to become of physiological importance, and the estimation of this gas is used as a basis for determining the efficiency of combustion of gas appliances. Now the actual concentration of carbon monoxide determined depends to some extent on the method and position of sampling. If the sample is also analysed for carbon dioxide, then the carbon monoxide produced per hour can be calculated. This result gives valuable data as to the concentration of carbon monoxide likely to be experienced in rooms, but it does not enable one directly to compare appliances burning different amounts of gas. Different workers have considered this question and various methods of comparison have been used. The American Gas Association has adopted a set of standards in its tests of gas appliances in which the concentration of carbon monoxide is determined in a room of 1000 c.ft. capacity having four air changes per 60,000 B.Th.U. of heat used. This method does take into account the calorific value of the gas used, but is based on an arbitrary set of conditions. In this country the results are generally expressed as parts of carbon monoxide per 10,000 parts of gas burnt, or as a ratio of carbon monoxide to carbon dioxide. Both these methods are, however, open to some objections. Both are suitable when appliances are tested with one particular coal gas, but neither takes into account the calorific value of the gas. The range of calorific values of coal gas existing in this country is quite large. The same amount of carbon monoxide produced per 10,000 parts of gas burned by different appliances with gases of different calorific value does not indicate that the combustion efficiency is equal. Further, the amount of carbon dioxide produced on combustion is proportional neither to the volume nor to the calorific value of the gas. To my mind, no combustion statement is complete if the quality of the gas is not specified.

A useful basis of comparison would be the volume of carbon monoxide formed per therm of gas burnt. Of course, knowing the characteristics of a gas used in a test, it is possible to express one result by any of these methods, as shown in Table 2, using a gas having a calorific value of 500 B.Th.U. and producing half a cubic foot of carbon dioxide per cubic foot of gas burnt.

Table 2

CO in C.Ft. per Therm of Gas Burnt.	CO per 10,000 of Gas Burnt.	CO/CO_2 Ratio.	A.G.A. Method. $C = \frac{60\,pv}{4 \times 1000}\left(1 - \frac{1}{e^4}\right)$*
0·02	1	0·0002	0·0003

* Where
C = Percentage of CO in a room.
v = Volume of undiluted products.
p = Percentage of CO in undiluted products.

This comparison, however, does not take into account the thermal efficiency of the appliance. Perhaps a better comparison could be made if results were expressed as the quantity of carbon monoxide produced by an appliance during the combustion of sufficient gas to produce a definite quantity—(say) 1 therm—of useful heat. Even here we have the difficulty of defining useful heat. Many appliances—for example, geysers, wash-boilers, &c.—have definite thermal efficiencies, but the thermal efficiency of some appliances cannot be determined with any exactitude (*e.g.*, ovens). These methods only compare appliances, and when the concentration of carbon monoxide likely to be produced in a room is required one must come back to the carbon monoxide produced per hour and the air change likely to occur. The comparison data must not be carried beyond their useful sphere, and it must be borne in mind that the data are independent of heating power, and equal figures produced by two different appliances will not indicate equal quantities of carbon monoxide being formed.

The American Gas Association has laid down a combustion standard for various appliances. I have converted them to the CO/CO_2 ratio basis using gas of 500 B.Th.U. calorific value and producing four cubic feet of undiluted products and half a cubic foot of carbon dioxide per cubic foot of gas burnt. These are compared in the following table with the results which we find may be expected from modern British gas appliances of good design.

Table 3.

Appliance.	A.G.A. Standard. C.	A.G.A. Standard. CO/CO_2 Ratio.	Modern British Gas Appliances. CO/CO_2 Ratio.
Geyser, 1·25 N . . .	0·02	0·014	0·009
Storage heaters, 1·4 N	0·04	0·027	0·009
Wash-boiler, 1·5 N .	..	..	0·005
Fire, N	0·02	0·014	0·005
Radiator, N.	..	..	0·001
Radiator, 1·2 N . .	..	..	0·002
Cooker oven, 2 N . .	0·01	0·007	0·001
Boiling ring, N. . .	0·01	0·007	0·005
Griller, N	0·01	0·007	0·005

N represents normal gas rate, 1·25 N 25 p.ct. overload on normal gas rate, &c.

It will be seen that our appliances are capable of a much higher combustion efficiency than is expected in U.S.A.

Prevention.

The question of the prevention of incomplete combustion is largely that of correct design of gas appliances. Apparatus design may be classed under four broad headings:

(1) Air inlet.
(2) Burner.
(3) Combustion space.
(4) Flue-ways.

For any appliance there is a limit to the quantity of gas that can be burnt with complete combustion. This limit may depend upon any or all of the above factors. With well-designed appliances this limit is beyond any gas rate likely to be obtained under district conditions. Incomplete combustion results when this limit is within the range of district variation. A geyser is an example of an appliance for which this limit can be easily demonstrated. Fig. 8 is a typical curve for a certain well-designed geyser. Its normal consumption was 75,000 B.Th.U., and it will be seen that the carbon monoxide produced is extremely low in this case until 85,000 B.Th.U. are being produced. This is the maximum amount of gas that can be completely burnt; if the gas rate is further increased carbon monoxide production increases very rapidly. The carbon dioxide curve

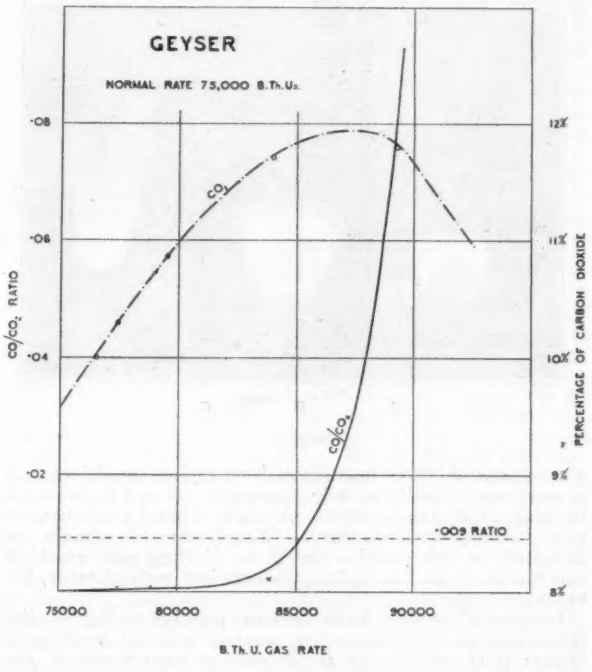


Fig. 8.

is interesting, as it will be seen that the maximum is 12 p.ct., very near the theoretical limit. This shows that practically all the air is going through the combustion zone.

Air Inlet.

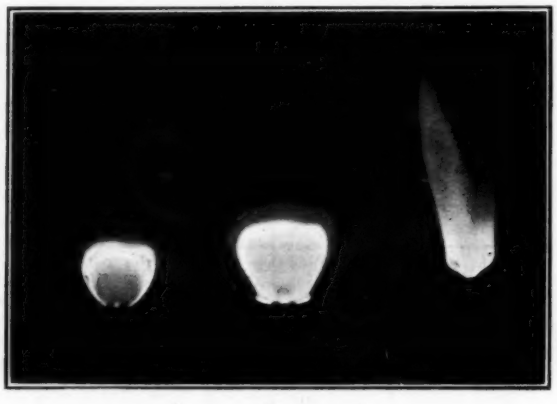
The flow of flue gases through the combustion space is largely controlled by the air inlet and flue outlet of the appliance. A restricted air inlet will have the same effect as a restricted flue outlet. The area of the air intake may be large enough to allow sufficient air to be drawn through the appliance by the flue pull, yet combustion cannot be effected if it meets the gases after they are cooled. The air inlets and distribution of the burner parts must therefore be arranged so that all the flames have an adequate supply of secondary air.

Burner.

The carbon monoxide produced from free burning flames, whether aerated or luminous, is very low. In most types of appliances, however, the flames are not free burning; combustion space, air inlet, and flue outlet are all limited, and correct burner design plays an important part in the efficient burning of gas. The production of carbon monoxide may be due to conditions which are noticeably wrong and are generally corrected, such as the lighting-back of burners, and flames blowing from teats. These conditions can be avoided if attention is paid to the burner design, and are outside the scope of this paper.

With aerated burners a certain quantity of the air for combustion is drawn in with the gas and mixes with the latter before it is burnt. This air is known as the primary air, and the quantity entrained at the air ports by the gas issuing from the injector depends on the mass of gas and the design of the burner. The correct adjustment of the air gas ratio—that is, the ratio of primary air to gas—is of great importance in the design. If this ratio is too great, a point is reached where the flame either blows away from the burner ports or flashes back. If the ratio is too small, a condition is reached where the flames assume a yellowish tinge and increase in length. This lengthening may cause the flames to impinge on the material surrounding the flame. In most types of cooker ovens this impingement does not occur, and a visible flame lengthening can take place without any serious increase in the carbon monoxide being formed.

Luminous burners have no primary air and must be placed so that the flames do not impinge on any solid surface, but burn freely in the surrounding air. Luminous flames may be unstable at high pressures. Fig. 9 is a



A B C

Fig. 9.

photograph of three burners under varying conditions. A is working normally at 2 in. pressure. B and C are both burning at 5½ in. pressure. A slight draught has caused C to become unsatisfactory. The flame will remain indefinitely in this position and flame chilling may result if this burner is used at 5½ in. pressure, in a water heater, for example.

Luminous burners have become popular owing to the increasing use of thermostatic control and the need for a burner that will remain stable over a large range of gas rates. It is found that the smallest amount of gas necessary to give a stable flame with normal luminous burners of good design is independent within limits of the size of the burner. Large burners can be cut down to the same minimum consumption as smaller burners. It will therefore be seen that a smaller number of large-sized luminous burners will be better from this point of view than a larger number of smaller burners, with thermostatically controlled apparatus, for a smaller stable by-pass consumption can be obtained. Luminous burners having normal rates between 2-10 c.ft. per hour can be cut down to give a stable flame with a consumption of less than ½ c.ft. per hour. Aerated flames cannot be cut down in this proportion. 10 p.ct. of the normal gas rate is the lowest that can generally be obtained. The type of burners used for many years in geysers is now being fitted in storage heaters, radiators, and quite recently cookers. The old slit batswing burner is also being used in radiators to give a flickering effect.

Design of Combustion Space.

Within the combustion space the gas is burnt, and air, known as secondary air, must be supplied to the flames in order that combustion may occur. Luminous flames having no primary air must have all the air required for combustion as secondary air. Thus the area of air intake and the size of the combustion space must be larger than when bunsen burners are used. As the rate of combustion is increased there will come a point above which the combustion space is too small to permit complete combustion before the gases are cooled below the reacting temperature, and the phenomenon of flame chilling will result.

Flue-Ways.

In order that combustion can take place the products must be removed from the combustion zone. This is effected by the upward displacement of the heated gases by the surrounding air, which is cold and therefore relatively heavy. The longer the column of hot gases and the higher the temperature up to 500° Fahr. the greater will be the quantity of flue gases removed. At temperatures above 500° Fahr. the mass removed will be substantially the same as at 500° Fahr. The resistance of the flue-ways in an appliance will tend to reduce the volume of flue gases removed.

Design of Flue Equipment.

This is not the place to enter into a discussion of flue equipment. Whole papers have been written on this subject alone, but mention must be made as far as it affects the combustion of the gas in an appliance. Flue equipment consists of three distinct sections. First there is the primary flue—that is, the flue pipe between the appliance and the baffler—secondly the baffler, and thirdly the secondary flue pipe from the baffler to the outside air. This latter section does not concern us, as it has no effect on the combustion of appliances.

By adding primary flue pipe to an appliance the flue pull may be increased, so that poor combustion may be improved by this means. A few years ago it was emphasized that as much primary flue pipe as possible should be fitted to a geyser, for in some cases combustion was not complete unless a few feet of primary flue were used. Appliances should be capable of complete combustion without any additional flue pipe. Sufficient primary flue pipe should be added to counteract the resistance of the baffler. One foot of primary flue pipe may be considered to be ample. This, of course, allows more secondary flue to be used, thereby making more certain that none of the products escape into the room.

The mere provision of flue pipe, even if efficient, does not avoid the necessity for complete combustion. Downblow will occur on occasions even with the best of terminals, for nothing short of a power driven fan will prevent downblow when the flue is subjected to sufficient static pressure due to wind. On the other hand, poor flue equipment can bring about incomplete combustion in an apparatus otherwise perfect.

General Summary.

The phenomenon of combustion is reviewed together with the physiological effects of the several products of complete and incomplete combustion.

The importance of carbon monoxide in incomplete combustion is emphasized, as it is the only gas that can be present in sufficient concentrations to be dangerous in the flue products from gas consuming appliances.

The combustion characteristics of various types of gas appliances are reviewed, and the amount of carbon monoxide to be expected is shown to be below any figure at which adverse physiological effects can occur.

The products of combustion from town gas can be, and should be, harmless. When this is not the case the cause can be traced to the various factors in the design of the gas appliances which are discussed.

Lastly I wish to thank the Gas Light and Coke Company for permission to publish this paper, and my colleagues at Watson House, especially Mr. C. A. Masterman, M.A., F.I.C., and Mr. F. C. Smith, Assoc.M.Inst.Gas E., F.C.S., for the help they have given me in its preparation.

Country Gas-Works Management*

By C. E. Taylor.

I would like to ask every gas engineer and manager two questions: "Are you proud of the fact that you are a gas engineer or manager?" "Would you advise your son to take up Gas Engineering as a profession?"

Why is it that the public to-day associates everything that is modern, everything that indicates progress, with electricity. That this inferiority complex is believed to exist in the gas industry is clearly indicated by the attitude of the public and Press to-day. If gas stoves were as dear as electric stoves, or if electric stoves suddenly became just as efficient as gas stoves, and could be sold at the same price, would we have the same sense of security regarding the future of our gas sales as we have to-day? Do we depend upon price or quality? Could we sell on a quality, and not a price, basis? If we could, then we need have no fear for the morrow.

I am firmly convinced that this inferiority complex does exist, and must be remedied. The world may not accept us at our face value, but if we depreciate ourselves then we can rest assured that it will certainly not elevate us to par. On the other hand, if we laud our values, then by the same reasoning it will accept us at par, if not above it. Above all, let us have increased confidence in our goods. How many gas engineers and managers to-day have a greater respect for electricity than for gas? Once, when I first started in the gas industry, I asked a gas engineer for his advice upon my future career. In all sincerity he advised me to study electrical engineering, his reason being that "it was the coming profession." This engineer had years of successful experience in the gas industry and believed what he said, but he had the inferiority complex.

A gas engineer once asked me why, when he walked up the business street of any town, every general merchant, hardware store, and even fancy goods shops displayed electrical appliances, whereas the gas company's showroom was the only place where one could view gas appliances. In return I asked if he could tell me why almost every gas stove and appliance manufacturer had taken up the manufacture of electrical goods. Before we can hope to advance we must rid ourselves of the inferiority complex.

Staff Training.

Staff training is the foundation of business success. It applies to every department of business, and it is vital to the success of the smaller works. Take the stoker generally found in country works. He is usually not a skilled man. He picked up his knowledge from another stoker who was never trained. "If I can make 12,000 or 13,000 c.ft. to the ton of coal, I'm all right," is his one idea. How he gets it does not matter; what it costs to get it matters less; why he throws coal into the retort, or what happens when it is in there, is of no concern to him. His job becomes a monotonous routine of mechanical action. Yet this man is the vital factor in retort house costs. Every shovelful of coal he handles costs good hard cash. He is the very hub of manufacturing costs, and yet he knows less about his job than the average blacksmith's striker knows about his. Would a manufacturing firm put this type of man in charge of its steam plant, or the smallest river launch owner in charge of his?

On country works, particularly where mechanical stoking does not exist, the greatest source of costs is in the hands of unskilled men. The use of a shovel, rake, or clinker bar is not the only requirement for skill. He must be encouraged, for a good, properly trained stoker is the greatest ally that the manager has. He must be trained in the working of the setting. He must be taught the principles of combustion—the difference between making gases and making thermal units; the value of CO lost up the stack; that cold air cannot be heated for nothing; that a setting of six retorts costs more than a steam boiler; that a generator producer is not a direct fire; that the damper is not to be used to overcome neglect of fire cleaning; that a scoopful of coal with a yield of 12,000 c.ft. per ton means 107 c.ft. of gas; that coke is worth 35s. per ton; that all the advertising and sales campaigns go for nought if the quality of the gas is not kept regular.

Teach him full appreciation of the responsibility of his position, and you must necessarily increase his status. He will have a greater interest in his work, and his net return will vastly improve, while the better class of man will be attracted to the position.

If dividends are made in the retort house, then the stoker is the only one who can determine which way the business shall go. The manager must understand that he is not the stoker, and that two men cannot be paid to do one job.

Staff training is most essential for the future, and yet it is a curious fact that a board of directors will spend £5000 in new plant and buildings, yet will refuse to spend £15 on efficient work on staff training to increase the present output of the business.

Distribution *versus* Manufacture.

The manager of to-day must devote the greater portion of his energies to getting business. He cannot afford to spend too much time on his works. The manufacturing side must take second place. This is where he reaps the full value of staff training, for if his stokers and works staff have been trained upon the lines previously suggested, the manager is relieved to devote his energies to obtaining new business. The daily works reports are sufficient guide of the progress there. It may be argued that, no matter what the revenue may be, if the costs of production are uneconomical then the business is no better off. True, but from an analysis of country gas-works costs it is curious to note that, except as caused by fluctuations in the price of coal, they do not vary very much from year to year. The gas yield per ton of coal is not much greater to-day than five years ago. The sales and unaccounted-for, on the other hand, tell a different story. Under present conditions a 10 p.ct. increase in sales is worth more than a 12 p.ct. reduction in the price of coal.

Summing up to this point, my views for the position of country gas-works managers are—District first, works second.

How is potential revenue to be estimated? Take the total number of dwellings in the municipality from the municipal annual report, multiply by the average consumption per meter, and you have it. Each year this factor will probably increase, and in turn this increase must be expressed as a percentage of the original potential revenue. Now instead of calculating your increases in sales as a percentage of the previous year, express it as a percentage of the potential revenue for that year. If the potential revenue has increased by 3 p.ct. and your sales by 2 p.ct., you have not held your own, irrespective of what the percentage of increase might be on the previous year's sales. If, on the other hand, your sales have increased beyond the percentage increase of potential revenue, then you have made more than natural increase, and due credit must be given to you for your sales efforts.

By using the law of averages in connection with potential revenue you have a fairly sound basis for calculating future prospects. If an analysis of percentage increases be made for (say) the past ten years in your district, this will be a fairly good guide in most country towns for future prospects.

Increasing the Percentage of Potential Revenue.

If a showroom does not already exist, or if existing is not in the main business part of the town, then one must immediately be opened there. The public will not visit the works, therefore it must be remembered that you will be judged by that part of your undertaking most apparent to the public eye, which will be your showroom. Do not confine yourself to the cheaper lines in the belief that no demand exists for the better class. If this demand does not exist at the moment, then create it. Yours is not a half-crown shop—and remember the electrical people can sell stoves at £30 each. In 99 p.ct. of your sales the woman is the deciding factor, and appearance counts more to her than anything else.

Connect gas on to various appliances—it gives an appliance life, and affords a wonderful opportunity to keep interest. Nothing attracts attention more than a working exhibit. More Briar heaters have been sold by the novelty of watching the gas light up and go out automatically than all the sales talk.

Remember the average customer has no idea of values and does not want to pay anything for an appliance; hence it is for you to create the desire for purchase. Prepare a sales talk on each and every appliance. Every appliance must have some particular feature. One will have an aluminium plate rack instead of cast iron, another has a retained heat oven, still another has a pilot attachment,

* From a paper before the Australian Gas Institute.

while a fourth has a bottom flue outlet. There must be a feature for every appliance. If you think that gas appliances do not lend themselves to sales talk, listen to the man on the street corner selling collar studs.

Have the prices of your appliances right to hand. Nothing is more aggravating than to be asked the price of an appliance and then have to run away to a catalogue or price book to find out. When you quote prices, quote them complete as exhibited. The mistake gas appliance manufacturers make to-day is to quote for the bare appliance and then tack on a list of essential extras. If you are displaying stoves complete with plate racks and floor plates, then quote inclusive prices. What would you think of a car salesman who, to create an impression of cheapness, told you the price of the car would be so much and the tyres extra?

Still one step further. Ascertain from previous installations the average costs of installing various appliances, and use these as a basis of an approximate estimate of installation costs.

The motor trade has taught us the value of the word guarantee. No matter what the word means, the public like to hear it; therefore guarantee any appliance for a definite term. Once a sale is effected deliver the appliance as speedily as possible. Few of us, once having made a purchase, can wait for deliveries. A customer might be 20 years making up her mind to purchase, but once the sale is made she wants it straight away. Therefore pay particular attention to prompt deliveries.

Quality, Not Price.

Get rid of the idea that it is the price only that counts. If this was so you would have no worry from electrical competition. Price should certainly be mentioned last in any sales talk. It should not be allowed to enter till the desire for possession has been created. Above all, do not cut reasonable profits to secure sales. The old idea has been that a gas undertaking's sole object was to sell gas, with the result that hundreds of pounds worth of appliances has been unreasonably given away. While this may be all right for the large, well-established undertakings, no country gas-works can afford to do it.

House-to-House Canvass.

Though the showroom is essential in promoting sales, the progressive manager does not allow his efforts to cease there. A large percentage of the public can be attracted into the showroom by effective display, but there is still a big majority which cannot be reached in this manner.

House-to-house canvassing is very different from and more difficult than showroom work. In the showroom the salesman is at home, which in itself is a great aid. He has the advantage of effective display, surroundings, furnishings, and appearance. The appliance can be seen, demonstrated, and handled. Then again, interest has been aroused, or the customer would not enter the showroom at all.

With house-to-house canvassing a different set of conditions is presented. The prospect's interest must be aroused. The appliance cannot be seen. It is not there to be handled or demonstrated. Therefore by his description alone the salesman must create imagination. House-to-house canvassing calls for the greatest degree of salesmanship, a degree which can only be reached by a thorough knowledge of goods on the one hand and psychology on the other.

Too long have we waited for the customer to purchase his appliances himself because they happen to be outside the usual run of goods. If there is an appliance which uses gas for any purpose, you must know all about it.

About two months ago a client walked into our showroom and asked for particulars of gas heated tyre-retreading machines. We had to confess that beyond the fact that they used gas we knew very little more about them. Here was a potential consumer of 10,000 to 20,000 c.ft. of gas per month; yet we could give him no information. Further, we had no idea where we could get the information.

Two suggestions I would like to make to our Committee for the best means of combating electric competition is to correlate particulars of all gas consuming appliances, details of use, process and purchase costs, and compile these into an indexed manual. I feel sure that every gas undertaking and gas salesman, every plumber and hardware merchant selling gas appliances, would be glad to have a copy. Manufacturers would be only too glad to co-operate.

My other suggestion is that we dispense with our present method of stating the price of gas at so much per thousand cubic feet. The public to-day have little knowledge of what a cubic foot of gas or a unit of electricity is. They compare the money values only, and ten shillings looks much dearer than a penny. If we are to retain the term cubic feet, why not alter our price to so many cubic feet for a penny?

Canvassing records are indispensable. These records should be made on cards which can be conveniently filed.

Aspects of Electricity Competition*

By A. E. Hutchison, of Sydney.

Recently a new electric bath heater came on the market in Sydney. It was invented by a local electrical engineer, who, in fact, has since been employed on its manufacture. It is a small non-contact type, and so can be used on direct current as well as alternating current. It is a very compact job, about 9 in. long, 5 in. wide, and 4 in. deep. When it first came to my notice, the description gave the impression that the gas bath heater was decidedly out of date; so, in company with the showroom supervisor and the publicity officer, I called on the managing director of the firm manufacturing this new device, told him who we were, and asked if he would give us some information regarding his heater. He gave us considerably more information than we expected to get. He explained his organization and showed us his laboratory reports. He took us along to the workshop, and showed us the heater in process of construction, the whole principle being explained to us.

The remarkable point was that this gentleman did not look upon the gas bath heater as a competitor. The only heater he had in mind, apart from his own, was another electrical machine, and he thought he could put that one off the market. Apparently from his point of view the gas heater was not in the same field.

I mention this to illustrate one of the principal phases of electricity competition—viz., that electricity is put forward as something up-to-date and gas as being prehistoric. There is no doubt that this view is held in some degree by a great number of people, the majority of whom are at present using gas, but feel that at some future date—when opportunity offers or the inducement is greater—they will install electrical appliances and enjoy modern conveniences.

My first point, then, is that the gas industry must keep in step with the development of electricity in the domestic field. At the moment we hold the advance position, but we no longer have a monopoly. So far as the production and distribution of gas are concerned, a high standard of efficiency must be maintained, but a factor growing in importance every day is the efficiency and satisfaction of gas service at the appliance.

Seals of Efficiency.

During the last twelve months, the N.S.W. Commercial Gas Association has been carrying out laboratory tests of cookers and bath heaters, in accordance with efficiency standards laid down by the Association. After Jan. 1, 1931, "Certificates of Efficiency" will be issued by the Association in respect of those appliances which have satisfied the tests, and manufacturers will be entitled to stamp all such appliances with the Association "Seal of Efficiency." To this extent, therefore, something tangible is being done to take care of the efficiency of gas appliances, but there is still much to be done by research and experiment to improve the methods of using gas for domestic purposes.

Installation practice (and incidentally the cost of the work) is likewise important, and recently revised rules for this purpose have been drawn up by the N.S.W. Commercial Gas Association. Inspection and maintenance of appliances are receiving attention by the different companies, but there is great scope for useful work in this direction. To retain the domestic load, goodwill is essen-

* From a paper before the Australian Gas Institute.

tial. To retain goodwill, good service is imperative. My view is that gas companies should be prepared to spend at least 3 p.ct. of their revenue in what is called "free inspection and maintenance" work.

It is my intention in these remarks to direct attention principally to the domestic uses of gas. Considerable attention has been given in recent years to the development of the industrial load. No doubt this offers great scope for the increased use of gas, but this load will never attain the importance of the domestic load unless there is a severe shrinkage in the latter. At the present time the larger companies in New South Wales are giving discounts for industrial users of gas, with the object of stimulating this business, but it must not be overlooked that the factor which makes this discount possible is that existing mains are primarily for the use of domestic consumers, and the industrial consumer is served without additional cost in this regard. Should, however, we lose the domestic load to any considerable extent, it will cease to be the carrier, for it will not bear a burden greater than itself. The result will be that the cost of gas for industrial purposes will automatically increase, perhaps to such an extent as to make it difficult to sell in competition with other fuels. The alternative to this method of reasoning is to give discounts for volume of use, irrespective of the nature of the use, on the ground that all large consumers are profitable.

Gas and Electricity for Cooking.

It is most important, therefore, to maintain the domestic load. At present over 95 p.ct. of houses on the line of mains are connected to the gas supply. Most of these use gas for cooking, but the extent of use of gas for cooking is being seriously affected by electricity competition. It is not that the gas stove is being replaced by an electrical cooker. Actually, the number of electric cookers installed on the line of gas mains is infinitesimal, but it is the use of electrical accessories, such as kettles, toasters, and the like, which has made serious inroads into the use of the gas stove for work it hitherto performed.

It may fairly safely be accepted at the moment that the electrical cooker is not a serious competitor of the gas stove, although its existence, and the fact that it is something modern, place on the gas industry a definite obligation to keep the gas cooker up-to-date, both in appearance and in serviceability. It cannot be gainsaid that the electrical oven is efficient from the technical point of view, although in actual use—owing mainly to the slowness of operation—it will be regarded by many domestic users as inefficient.

Notwithstanding the existing deficiencies in electrical appliances for cooking purposes, there are many people quite anxious to install them, and the desire gains impetus when they experience the least dissatisfaction with gas. The fact that the electrical appliance is something modern; that in outward appearance it is clean; that there are no fumes or flue troubles to contend with, and no matches to fumble with, are all potent influences having the effect of bringing the gas stove into disfavour.

There is, however, no need to be pessimistic in regard to the cooking load. It is not uncommon for people who have tried electricity to revert to gas. I suggest that, if the appliance manufacturer continues to put on the market a thoroughly efficient and attractive cooker, and that consumers' appliances are functioning satisfactorily, and if the gas companies continue to supply gas of good quality at adequate pressure, there is every reason to hope that the cooking load will wholly or mainly always be ours.

Here is an opportunity for a research and experimental bureau or laboratory. Why should not a thoroughly efficient water boiling compartment be added to a gas stove? And why cannot a better toaster and griller be designed? A research bureau for the improvement and development of gas making practice has often been discussed, but I suggest it is just as important to concentrate on improvements in gas using practice.

Water Heating.

I referred previously to bath heaters, pointing out that certain electrical manufacturers apparently did not regard gas as being in the same field. There is no doubt that gas has not so far secured a sufficient share of water-heating business relative to its importance as a heating service. We are, in fact, a long way from saturation point as far as hot water is concerned. From statistics available it is known that in some suburban areas of Sydney roughly only 25 p.ct. of consumers have bath heaters installed, and about 40 p.ct. have gas coppers. The proportion varies according to the nature of the district, but these figures indicate that there is considerable scope for extending the use of gas in the water-heating field.

At the same time it must be evident that this is the field in which electricity has made the greatest inroads into the gas business, and will continue to do so if the gas industry does not pursue a progressive policy. A few years back, electricity made substantial progress with storage systems, current being sold at a flat rate according to the size of the element used. There was nothing of a competitive type available for use by gas heating. There has, however, been a remarkable change in this aspect of water-heating business during the last year or two. Several gas-operated storage systems of continuous and automatic type have come on to the market, and a fairly substantial number have been placed in consumers' premises.

Very recently the Sydney companies introduced a 25 p.ct. discount for gas used by storage heaters, and there are indications that this will open up many new opportunities for the use of gas for hot-water supply.

It is important to note here that the gas industry has learnt much from the mistakes of its electrical competitors. Many electrical storage systems were installed to supply blocks of flats. These installations were advertised as inducements to probable tenants, the electrical system being an indication that modern conveniences were available. Two cardinal mistakes, however, were made with a number of these installations. First—probably as the result of representations by electrical salesmen—owners of the flats thought they were getting a cheap method of water heating; and, to ensure that it was cheap, a smaller electrical element was used than was essential for good service. Secondly, a central storage system to supply a block of flats cannot be successful unless it is of a sufficiently large capacity to meet the maximum demands of tenants with extravagant habits. These extravagant habits are encouraged by the belief that hot water is available at the turn of the tap, but often this applies only to the tenants who make first use of the bath.

The lesson to be learnt from the mistakes of electrical systems is that it is useless to install a central storage system for a block of flats where cost is to be kept at a minimum, and no means of quick recovery of hot water are provided. This experience has led many owners of flats to convert their water-heating systems to separate units, leaving the tenant to pay direct for his own hot water. The electrical bath heater thus found a good market, especially where no provision existed for flues. We have, on the other hand, had many inquiries, and have completed many sales for service heaters and bath heaters to supply flats where previously electrical storage systems were in use. Our great handicap, however, is the cost involved in piping a block of flats for gas where this piping did not previously exist.

The "Gas Unit."

We all know that gas is cheaper than electricity, but it is remarkable how many people outside the gas industry have the idea that electricity is cheaper than gas. There is a class of consumer who thinks that, because his quarterly bill for electric light is so much less than his gas bill, electricity is cheaper than gas. There are a number who cannot imagine that a commodity sold at 5s. 9d. or 6s. can be cheaper than a commodity sold at 1¼d. It seems so ridiculous on the face of it! I have had this argument put to me by builders, and when their intelligence has been appealed to by a discussion of relative heat values, they have acknowledged, with some surprise, that their ideas on the subject have been completely wrong.

This question of the comparison in price between electricity and gas is becoming an important factor in the competition between the two heating services. It has, I think, been given more importance than it is entitled to, at any rate, from some points of view. It may be thought that, because gas can give better service in many directions than electricity, the question of price is a secondary consideration. This, however, entirely disregards the psychological aspect of the matter. The householder in these days looks for modern labour-saving conveniences; and as gas has been in use in Sydney for 90 years and electricity is something more recent, it is naturally assumed that the modern way is the electrical way. In any case, the magic of the electrical switch has a big appeal.

This again emphasizes the point previously made that our gas appliances must always be modern. Gas in the home is a long-established fact, but the appliances must keep pace with the times, so that any consumer looking for an improvement in household equipment will turn first to modern appliances in the service already available, rather

than try something new. We must, therefore, stress in all our propaganda and practice the use of *modern* gas appliances.

Having this in view, the Sydney gas companies within the last twelve months introduced a system of trading-in of old gas appliances for new, and, so far as the experience of the Australian Gas Light Company indicates, this has been responsible for many installations of new gas appliances where the old have been giving unsatisfactory service, and where the probability always existed of discarding gas for electricity.

On the question of price, an important suggestion was brought before a sectional meeting of this Institute held in Sydney last year. At that meeting the subject was introduced by myself with a suggestion that gas should be sold at so many cubic feet for a penny, the point being that this would appeal to the psychology of the great majority of consumers, and combat the idea that electricity at 1¼d. was cheaper than gas. Mr. Banks (Industrial Fuels Officer of the Australian Gas Light Company), during the discussion which followed, suggested that a gas unit of 3415 B.Th.U. (the equivalent of an electrical unit) should be the basis of the price of gas, pointing out that if gas were sold in this way the comparative cost with electricity would be immediately known.

Of course, it would be necessary to educate the public to the knowledge that a gas unit was equal in heat value to an electrical unit, and this may not be as easy as it seems, because many people would assume that gas at less than ½d. per unit would be of considerably less value than an electrical unit costing 1¼d. or more.

However, much would be gained by adopting Mr. Banks' suggestion; and although nothing tangible has been done since the proposal was put forward, I do not think it has altogether been overlooked. At any rate, I suggest that this Institute should take up the matter in some definite manner, to secure some better basis of selling gas than the present, as soon as it is practicable to do so.

Scottish Junior Gas Association (Western District)

CONTINUOUS VERTICALS

By W. A. Currie, of the Provan Gas-Works, Glasgow.

The coals carbonized at the Provan Gas-Works consist almost entirely of Lanarkshire Main, ell, splint, gas, and Haughrigg coals, a large proportion being unscreened. Coals such as those of the Kilsyth coking seam are avoided. The caking and swelling properties of these coals increase in the order: gas and splint, main, ell, Haughrigg.

Effects of Temperature on Carbonization.

The temperature affects carbonization in the following ways:

1. The higher the temperature the greater the conductivity of coke, so that more heat can be applied to the coal, and more coal can be carbonized in the same time if the temperature is high, giving considerable economic advantages. Dr. Parker (Trans. Inst. Gas Eng., 1928) found that a medium caking Nottingham coal gave at 630° C. 9 p.ct., and at 819° C. 44 p.ct. of its make per hour at 979° C. Similarly (J. West, Trans. Southern Assoc. Gas Eng., 1917), showed the large increase in therms per retort per day, in a report on a research from which the following are abstracted:

Temperature of flues	1362° C.	1150° C.
Throughput tons per retort per day	4·17	2·23
Therms per ton	78·1	77·3
Calorific value of gas	556	567·7
Therms per retort per day	333·7	168·5

2. The strength of the coke is dependent on the temperature to a considerable extent. Unless a certain temperature is attained (about 750°-850° C. according to the coal) a coke, as apart from a low-temperature fuel, is not obtained.

3. The efficiency of the conversion of steam to water gas increases rapidly with rise in the temperature at which the reaction takes place, the percentage decomposed and in equilibrium increasing from 13 to 83 as the temperature rises from 700° C. to 1000° C. Although it is possible that the reactants do not form the maximum water gas theoretically possible, the higher equilibrium constants at the higher temperatures are bound to have an added force in that direction. The result is that the same ratio of steam to coal has a more drastic effect on the calorific value of the gas when the temperature is high than when the temperature is low.

4. In a similar way the higher temperatures have a greater tendency towards decomposition of the tar. Owing to the nature of the continuous vertical retort this degradation of the tar is not so severe as in other forms of carbonizing plant.

5. At temperatures over 500° C. ammonia tends to revert to nitrogen and hydrogen. This tendency is usually more than neutralized by the increased formation of gases in the retort with the corresponding shorter time of contact in the retort and the lower partial pressure.

6. The proportion of volatile matter left in the coke decreases, and the calorific value of the volatile matter evolved on further heating degenerates towards that of hydrogen.

7. It is perhaps worthy of note that Dr. Parker, in the research previously mentioned, obtained the maximum yield of tar at 630° C. and of ammonia at 725° C.

Rate of Carbonization.

The rate of carbonization may be varied in practice in proportion to the current requirement by adjustment of the extractor device, either at the individual screws, at the bar driving these screws, or at the engine, according to the number of retorts involved. Each coal has a rate of carbonization, depending on the size of the coal pieces and its swelling power, which gives the best results.

The throughput at the Provan works (rated at 7 tons per day) which gives the maximum therms per ton varies from 6·4 for the medium caking coals to 6·8 tons for the low-caking coals, according to the grade of coal (singles, trebles, &c.) and its purity. The temperatures are maintained at 1200° C. at the top. This usually results in a bottom temperature of 1000° C., with a temperature for the coke where it reacts with the steam of about 800° C. According to the theoretical tables, this would give an efficiency for the water gas reaction of 33 p.ct. steam converted and a water gas analysis of: CO, 11 p.ct., H_2, 64 p.ct.; CO_2, 26 p.ct.; C.V., 250 B.Th.U. per c.ft.

It will be remembered in this connection that the maximum therms per ton are not necessarily given by the throughputs which give the best economic returns, since the minimum cost of gas is more nearly in proportion to the therms per retort per day, carbonizing wages, wear of plant, power, &c., being more nearly proportional to the number of retorts in action than to the coal carbonized. An example of this occurs in the case of some tests mentioned later.

The rate of carbonization should not be confused with the extractor speed, which is dependent also on the specific volume of the coke—*i.e.*, on the total volume of coke passed while the throughput or rate of carbonization is proportional to the weight of the coke.

In an investigation by the Fuel Research Board (Tech. Paper No. 26) it was shown that by increasing the throughput of the largest pieces (sizes) of a swelling coal from the standard 2·5 tons per day to 4·01 tons per day, a decrease of 9·5 therms per ton was found with an increase of 100 therms per retort. Similarly, a smaller sized quantity of the same coal showed, on raising the throughput from 2·5 tons to 3·25 tons per day, a decrease of 9·3 therms per ton and a decrease of 13·5 therms per retort. In the first case considerable economies would be possible by increasing the throughput, while in the second no such benefits are to be obtained. Another large sized coal on raising the throughput from 2·50 tons to 4·27 tons per day gave a decrease of 8 therms per ton and an increase of 133 therms per retort, showing again the necessity for increasing the rate of carbonization of large sized coals if the best commercial results are to be obtained.

Coal Size and Swelling Power.

The coal size affects the results in two ways—chemical and physical.

The chemical effect is due to the separation of smaller, softer fusain type of coal from the harder durain and clarain types, the soft coal taking with it dirt and ash not inherent in the coal. There is thus a difference in yields caused by the dilution due to the ash, and to the low quality of the gas given by fusain. The large coal has little

ash and gives a much richer gas. Two fractions of the same coal gave 6 p.ct. ash in the fraction over 3 in. and 15·5 p.ct. in the fraction under ½ in. Similarly, the swelling power and caking index were slightly greater in the larger coal, showing a preponderance of agglutinating agents.

The physical effects are due to the greater conductivity, exposed surface, and the reduced free space of the small coal. The primary products evolved are more thoroughly decomposed in passing through the tightly packed small coal. By packing tightly, the particles of small coal more easily form a coherent coke.

Coal size is intimately connected with the swelling power of the coal, since the optimum throughput depends on the balancing of these factors, large size balancing great swelling power, and *vice versa*. The results obtained vary according to the free space in the semi-coke during gas-making. When the free space in the semi-coke is high the gas gets away with the minimum of cracking, and the tar yield is high. As the free space decreases, increased cracking takes place; richer and more gas is formed at the expense of the tar until a maximum is reached, when the retort is almost blocked. After this the degradation of the tar is excessive, and further closing-in of the charge only reduces the yield of gaseous hydrocarbons and involves increased rodding to keep the charge moving. The optimum throughput, therefore, is that which gives the maximum conversion of tar to gaseous hydrocarbons. It may be calculated approximately from the swelling power and the free space.

When the coke is made from highly swelling coals in large pieces, it is very porous and weak, so that benefits gained in easy working of the coal are lost by increased breeze formation on handling. It is evident that, by adjustment of size, it is theoretically possible to carbonize continuously any type of coal in a vertical retort. That this is impossible in practice without the use of ovens or intermittent retorts is also clear. The maximum size is fixed by the size of the mouthpiece and inlet coal chute and by the strength of the coke produced. The minimum size is set by the rodding required and the maintenance of the minimum requirement of free space.

Segregation in Bunkers.

A practical effect of the difference in size is caused by the irregular distribution of sizes by the chute above the hopper. The largest coal spreads out to the edges of the cone—*i.e.*, along the wall of the hopper and partly over the adjacent retorts. By distributing the coal in small lots at a time over the individual retorts a fairly even mixture of coal is set above the retort, but a mass of the largest coal collects along the wall. The effect of this is to leave two fractions, which require different extractor speeds and steaming to make the standard gas.

The mixed coal is carbonized from the time the bunker is charged—*i.e.*, from 7-8 a.m.—till it is finished about midnight, when the big coal begins to come down in increasing proportion. Since the large coal gives a coke of higher apparent specific volume, the engine speeds are increased when the larger coke is due to arrive at the extractor, about seven hours after it enters the retort, usually 6 a.m. They are reduced after the large coal has been carbonized.

Control of the Factors Affecting Carbonization.

In certain cases the distillation tests such as the Gray-King do not give cokes of similar appearance to those obtained from crucible methods, owing, presumably, to the different rates of heating. In the second class the rate of rise of temperature must be much higher than in the first class, so that the portions of the coal which fuse decompose during fusion, giving a strongly swollen coke; while in the second class the gas is evolved to some variable extent before fusion takes place, giving a less swollen coke. In this connection Andibert showed ("Revue de l'Industrie Minerale," March, 1926, p. 115) that all of twelve coals examined by him had their caking powers removed by heating at a temperature below the softening-point for periods from 15 mins. to about 100 hours.

In attempts to evolve a simple practical test for gas-works, the following method gave satisfaction. One-third gramme of coal, ground through a 60 sieve, was transferred to a prepared silica tube 10 cm. long and 8 mm. bore, containing a plug made of a small amount of asbestos in the form of a tightly packed disc 2·3 mm. thick. The plug was made in the tube, about 0·5 cm. from the bottom, by inserting a stopper made of glass rod, followed by the quantity of asbestos required, which was then pressed by a small pusher into the form of a compact disc. The distance of the surface of the disc from the top of the tube was measured and the coal inserted. After shaking-down to form what was almost a pellet, the distance of the top of the coal from the end of the tube was measured by inserting a rod, as before, and the length of coal found by difference. A carbon rod 6 mm. diameter, weighing 2 grammes, was inserted, and the end of the tube rapidly heated to 900° C., at which temperature it was heated for 5 mins. After allowing to cool, the charge was pushed, and the coke broken from the carbon and measured. The increase calculated as a percentage gave the "Swelling Power"-of the coal.

The results were concordant if the test was always done in exactly the same manner, except that allowance had to be made in occasional cases for a hollow which formed at the side of the tube of coke.

The results obtained were of the following order:

—	Main.	Ell.	Splint.	Haughriggs.	Kilsyth Coking.
Swelling power . . .	5–10	5–10	0–5	15–20	40–50
Caking index	4	4	3·5	9	25

Although these tests give similar results they really measure different properties of the coal. The swelling power is a measure of the gas held in the coke during fusion, while the second, caking index, is a measure of the agglutinating properties of the coal, and therefore more applicable to blending of coals than to carbonization of single coals alone.

This test and the results obtained are not put forward as perfected, but in the hope that they may be considered and adapted by members who are in a better position to continue the work. At Provan, for instance, the daily throughput varies from 400 tons to 1300 tons per day and usually includes several coals of extremely different properties, which prevents any particular knowledge of the throughputs for individual coals being obtained. At smaller works, the confusion caused by size and variation in coal is absent, and results of a practical nature should be obtained.

Calculation of Optimum Throughput.

The optimum throughput may be arrived at in the following ways:

(1) Full-scale trials on the plant to be used.
(2) By determination of the residual volatile matter in the coke.

The Fuel Research Board used this method in some recent tests (Technical Paper No. 26) and decided on a figure of 1 p.ct., which in some cases, as we have already seen, was rather low.

So far as I am aware the general method used in gas-works for this determination is to heat the coke exactly as in the corresponding test for coal. Much more accurate results are obtained by first moistening the contents of the crucible with alcohol or by placing a layer of 0·2 to 0·25 gramme of non-swelling coal on the bottom of the crucible, deduction being made for the coke formed from the coal.

(3) By calculation.

It is evident that the throughput is a function of the swelling power and the free space in the coal charge during carbonization. Several possible formulæ may be devised which take these into account, with or without the various factors which affect carbonization.

Unfortunately there is little satisfactory evidence or data with which these might be studied, the tests which have been carried out having measured the free space factor as a size analysis and the swelling factor as a caking index. These give, however, approximate values, by calculation, of the factors with which we are concerned. Taking into consideration the percentage accuracy of commercial carbonization and the errors necessarily involved in the calculation, the best equation is the simplest:

$$\mathrm{Tr} - \frac{\mathrm{KF}}{\mathrm{P}}$$

Where Tr = the throughput; F = free space; P = swelling power. K is a constant for each installation of retorts, and covers local conditions such as varying dimensions of retorts, rate of heating, temperature of carbonization, &c. It also covers the difference between the free space in the coal as charged and the free space in the coal during carbonization. Similarly it covers the difference between the swelling at the decomposition temperature of the caking bodies—say, 370° C. to 450° C.—and the final swelling as measured in the test.

Like the method of estimating swelling power, this equation is put forward as a first approximation. It will be observed that if the swelling power is *nil* the throughput is infinitely great. In this case the limiting factor is the quantity of heat which may be transferred to the coal.

A sufficiently accurate figure for the free space may be obtained from the formula

$$\mathrm{F.S.} = \frac{1220 - \mathrm{W}}{1220}$$

where W is the weight of 1 c.ft. of the coal in ounces.

GAS MARKETS & MANUFACTURES

Stock Market Report.

[For Stock and Share List, see later page.]

The optimism displayed the previous week was dispelled at the outset last week, and most markets were irregular and dull. British Funds were no exception, and closed lower on Friday.

The prices of gas stocks and shares, however, continued firm, and several issues showed further improvement. Gas Light and Coke £1 units, following a rise of 7½d. the previous week, gained another 6d. to 20s. 6d.-21s., and were in good demand. Harrogate consolidated and Imperial Continental both showed gains of 5 points to 162-167 and 350-370 respectively, and Barnet ordinary improved 4 points to 112-117. South Metropolitan ordinary and Croydon sliding-scale each rose 1 point. With the exception of Imperial Continental, these stocks, among many others, will shortly become *ex* div., so that the current prices include a full half-year's dividend.

The popularity of gas in Australia is evidenced by the excellent results obtained for the past six months by the Metropolitan Gas Company of Melbourne. The net profit amounted to £135,380 (against £100,772); a dividend of 6s. 6d. per share (same) has been declared; £50,000 has been transferred to reserve (against £36,184 to capital account); leaving £43,460 to be carried forward (against £41,205).

The recent sale by tender of £150,000 5½ p.ct. preference stock of the Tottenham and District Gas Company met with an overwhelming response. The minimum price of issue was £104, and the average price of the tenders accepted was £104 11s. 1d. p.ct.

Current Sales of Gas Products.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *Feb.* 2.

There are no changes to report in the prices of tar products.

Pitch is still 45s. per ton f.o.b.

Creosote, for export, 5¼d. to 5⅝d. per gallon f.o.b.

Spirits are also about the same.

Pure toluole is 1s. 11d. to 2s.; pure benzole, about 1s. 8d.; solvent naphtha, 95/160, about 1s. 5d.; and pyridine bases, 3s. 6d. to 3s. 9d., all per gallon *ex* sellers' works.

Tar Products in the Provinces.

Feb. 2.

The average prices of gas-works products during the week were: Gas-works tar, 18s. 6d. to 22s. 6d. Pitch—East Coast, 43s. to 43s. 6d. f.o.b. West Coast—Manchester, Liverpool, Clyde, 43s. to 43s. 6d. f.o.b.* Toluole, naked, North, 1s. 6½d. to 1s. 7¼d. Coal-tar crude naphtha, in bulk, North, 9d. to 10d. Solvent naphtha, naked, North, 1s. 2½d. to 1s. 3d. Heavy naphtha, North, 11d. to 1s. Creosote, in bulk, North, liquid and salty, 3⅝d. to 3⅞d.; low gravity, 1⅝d.; Scotland, 3⅜d. to 3⅝d. Heavy oils, in bulk, North, 5⅜d. to 5⅞d. Carbolic acid, 60's, 1s. 2d. to 1s. 2½d. Naphthalene, £10 to £12. Salts, £8 to £5, bags included. Anthracene, "A" quality, 2½d. per minimum 40 p.ct., purely nominal; "B" quality, unsaleable.

* All prices for pitch are now quoted on the basis of f.o.b. In order to arrive at the f.a.s. value at any port, it will be necessary to deduct the loading costs and the tolls whatever they may be.

Tar Products in Scotland.

GLASGOW, *Jan.* 31.

There has been some movement in creosote oils during the week, and comparatively large orders are reported to have been placed on the home market. Other products remain quiet.

Pitch.—Few orders are being received. Nominal value remains at 42s. 6d. to 45s. per ton f.o.b. Glasgow for export, and about 42s. 6d. per ton f.o.r. works for home trade.

Refined tar to Ministry of Transport Specification shows a further drop in value to 2½d. to 2⅝d. per gallon f.o.r. makers' works, naked.

Creosote.—Further orders have been received, and quotations are steady. B.E.S.A. Specification is 2⅝d. to 3d. per gallon; low gravity, 3¼d. to 3½d. per gallon; and neutral oil, 3d. to 3⅛d. per gallon—all in bulk *ex* works.

Cresylic.—Any orders being placed are for small quantities. Pale, 97/99 p.ct., is 1s. 6d. to 1s. 7d. per gallon; dark, 97/99 p.ct., 1s. 5d. to 1s. 6d. per gallon; and pale, 99/100 p.ct., 1s. 8d. to 1s. 9d. per gallon—all f.o.r. works.

Crude naphtha.—Production continues low, and value is steady at 4d. to 4½d. per gallon *ex* works.

Solvent naphtha.—Orders are falling away again, but prices are unchanged; 90/160 being 1s. 2½d. to 1s. 3½d. per gallon; and 90/190, 1s. to 1s. 0½d. per gallon.

Motor benzole.—Unchanged, with value about 1s. 4d. per gallon f.o.r. in bulk.

Pyridines remain dull. 90/160 is 3s. to 3s. 3d. per gallon.

Benzole Prices.

The following are considered to be the market prices at the present time:

	s. d.		s. d.	
Crude benzole	0 7½	to	0 8½	per gallon at works
Motor ,, ...	1 3	,,	1 4	,, ,, ,,
Pure ,, ...	1 7⅛	,,	1 8⅛	,, ,, ,,

New Capital Issues.

Tottenham Gas Company.—The issue of £150,000 5½ p.ct. preference stock by the Tottenham and District Gas Company was over-subscribed, the average price of the tenders being £104 11s. 1d. p.ct.

The Aldershot Gas Company.—The result of the tenders for stock of the Aldershot Gas, Water, and District Lighting Company, particulars of which appeared in last week's "JOURNAL," was, it is announced, as follows: Tenders received amounted in all to £540,000. All tenders submitted at 76 p.ct. and over will be allotted in full, and tenders submitted at 75¾ p.ct. will be allotted at 94 p.ct. Letters of allotment and regret will be posted to-morrow (Thursday).

Contracts Advertised To-Day.

Coal.

The Wallasey Corporation invite tenders for the supply of coal. [Advert. on p. 288.]

General Stores.

The City of Stoke-on-Trent Gas Department invite tenders for the supply of various stores. [Advert. on p. 288.]

Mantles.

The City of Stoke-on-Trent Gas Department invite tenders for the supply of mantles. [Advert. on p. 288.]

Pipes, &c.

The Middleton Corporation Gas Department invite tenders for the supply of cast-iron pipes. [Advert. on p. 288.]

The City of Stoke-on-Trent Gas Department invite tenders for the supply of wrought-iron tubes and fittings. [Advert. on p. 288.]

The Gas Committee of the City of Stoke-on-Trent invite tenders for the supply of cast-iron pipes and connections. [Advert. on p. 288.]

Sulphuric Acid and Lime.

The Wallasey Corporation invite tenders for the supply of sulphuric acid and lime. [Advert. on p. 288.]

Trade Notes.

New Purifiers for Bangor (Co. Down).

Messrs. Ashmore, Benson, Pease, & Co., Ltd., of Parkfield Works Stockton-on-Tees, have received an order from the Borough Council of Bangor (Co. Down) for two dry lute purifiers, each 33 ft. by 20 ft. by 6 ft. deep, complete with valves, connections, and double-jib crane running on centre deck plates, for lifting the covers of the purifiers.

An Attractive Desk Calendar.

Messrs. W. C. Holmes & Co., Ltd., of Huddersfield, have struck a new note in the production of their calendar for 1931, which they are distributing to their business friends. This forms a most attractive "piece" for the office desk, and combines with the calendar for the month exceedingly well executed illustrations reproduced from an artist's drawings, based upon authentic portraits of early pioneers of the Gas Industry. These portraits may be framed separately if they are considered of sufficient interest. The first portrait is, appropriately enough, that of William Murdoch, while the second is of James Watt. These will be followed by others in the series. A brief biographical note is given with each.

STOCK AND SHARE LIST.

[For Stock Market Report, see earlier pages.]

Issue.	Share.	When ex-Dividend.	Dividends. Prev. Hf. Yr.	Dividends. Last Hf. Yr.	NAME.	Quotations. Jan. 30.	Rise or Fall on Week.	Transact'ns Lowest and Highest Prices During the Week.
£			% p.a.	% p.a.				
171,978	Stk.	Aug. 14	5	5	Aldershot 5 p.c. max. C.	73—78	..	..
522,992	,,	,,	4	4	Do. 4 p.c. Pref.	73—76	..	..
1,551,868	,,	Oct. 9	7½	7½	Alliance & Dublin Ord.	100—105	..	..
374,000	,,	Jan. 8	4	4	Do. 4 p.c. Deb.	70—75	..	..
522,655	,,	Aug. 28	7	7	Barnet Ord. 7 p.c.	112—117	+4	111½—112
800,000	1	Oct. 23	1/4½	1/7½	Bombay, Ltd.	15/6 17/6	..	..
174,500	10	Aug. 14	9	9	Bournemouth 5 p.c.	14½—15½	..	..
500,050	10	,,	7	7	Do. B 7 p.c.	12½—13	..	12⅝—13
489,160	10	,,	6	6	Do. Pref. 6 p.c.	11—11½	..	..
50,000	Stk.	Dec. 18	3	3	Do. 3 p.c. Deb.	60 68	..	..
162,025	,,	,,	4	4	Do. 4 p.c. Deb.	81—84	..	..
357,900	,,	Aug. 28	7½	7½	Brighton & Hove 6 p.c. Con.	112 117	..	..
371,880	,,	,,	6½	6½	Do. 5 p.c. Con.	102—105	..	..
1,287,500	,,	July 24	5	5	Bristol 5 p.c. max.	93—95a	..	..
855,000	,,	Sept. 25	8	7	British Ord.	110—115	+1	113—114½
100,000	,,	Dec. 18	7	7	Do. 7 p.c. Pref.	109—114	..	..
120,000	,,	,,	4	4	Do. 4 p.c. Red. Deb.	74—77	..	..
450 000	,,	,,	5	5	Do. 5 p.c. Red. Deb.	95—98	..	..
100,000	,,	Jan. 8	5	5	Cambridge 5 p.c. Deb.	95—98	..	..
100,000	10	Dec. 4	10	6	Cape Town, Ltd.	8½—9½	..	..
100,000	10	Nov. 6	4½	4½	Do. 4½ p.c. Pref.	6½—7½	..	..
150,000	Stk.	Dec 18	4½	4½	Do. 4½ p.c. Deb.	70—75	..	..
626,850	,,	July 24	6	6	Cardiff Con. Ord.	95—98	..	..
287,850	,,	Jan. 8	7½	7½	Do. 7½ p.c. Red. Deb.	97—100	..	..
157,150	,,	Aug. 14	6½	5	Chester 5 p.c. Ord.	86—91b	..	..
98,936	1	Oct. 9	†2/-	†2/-	Colombo, Ltd. Ord.	32/—34/-	..	..
24,500	1	,,	1/4½	1/4½	Do. 7 p.c. Pref.	18/—20/-	..	..
609,204	1	Oct. 9	1/9½	1/4½	Colonial Gas Assn. Ltd. Ord	16/6—18/6	..	..
296,053	1	,,	1/7½	1/7½	Do. 8 p.c. Pref.	18/—20/-	..	..
2,078,280	Stk.	July 24	7	6	Commercial Ord.	95—98	..	97¼
475,000	,,	D-c. 18	3	3	Do. 3 p.c. Deb.	57—60	..	..
787,550	,,	Aug. 14	7	7	Croydon sliding scale	107—110	+1	108½—110
453,100	,,	,,	5	5	Do. max. div.	83—86	..	85½—86
642,270	,,	Aug. 14	10	7	Derby Con.	115—125a	..	..
65,000	,,	Dec. 18	4	4	Do. Deb.	65—70a	..	..
209,000	,,	Aug. 28	5	5	East Hull Ord. 5 p.c.	72—75	..	..
1,002,180	,,	Sept. 25	†7g	†4	European, Ltd.	100—110	..	100½—104
18,953 033	,,	July 24	5⅝	5⅝	Gas Light & Coke 4 p.c. Ord.	20/6—21/-f	+/6	20/—20/9
2,600,000	,,	,,	3½	3½	Do. 3½ p.c. max.	64—66	+½	65½—66⅝
4,294,691	,,	,,	4	4	Do. 4 p.c. Con. Pref.	79—84	..	80⅝—81½
5,634,095	,,	Dec. 18	3	3	Do. 3 p.c. Con. Deb.	61—64	..	62⅛—63⅛
3,642,770	,,	,,	5	5	Do. 5 p.c. Red. Deb.	100—103	..	102½—103
161,480	,,	Sept. 11	10	10	Harrogate Cons. 10 p.c. max.	162—167	+5	..
82,500	,,	Aug. 28	7	7	Hastings & St. L. 5 p.c. Conv.	98 -103	..	..
258,740	,,	,,	5½	5½	Do. 3½p.c. Conv.	82—86	..	..
70,000	10	Oct. 9	1	10	Hongkong & China, Ltd.	13—14	..	..
218,200	Stk.	Aug 14	6	6	Horn-ey Con. 3½ p.c.	88 - 91	..	..
2,436,594	,,	Nov. 6	25	15	Imperial Continental Gas.	350 -370	+5	354—363
228,180	,,	Aug. 14	3½	3½	Do. 3½ p.c. Red. Deb.	80—85	..	..
235,242	,,	Aug. 14	8½	8½	Lea Bridge 5 p.c. Ord.	127—132	..	..
2,145,907	,,	Aug. 14	6	6	Liverpool 5 p.c. Ord.	97 -98b	..	..
600.000	,,	Sept. 25	7	7	Do. 7 p.c. Red. Pref.	99—101b	..	..
165,736	,,	Aug. 28	8	9	Maidstone 5 p.c. Cap.	123 -128	..	..
63,480	,,	Dec. 18	3	3	Do. 3 p.c. Deb.	54 -57	..	..
75,000	5	Dec. 4	†10	†10	Malta & Mediterranean	5⅝ -6⅛	..	..
892.000	—	Oct. 1	5½	5½	Metrop'itan (of Melbourne) 5½ p.c. Red. Deb.	88 -91	..	..
675,000	Stk.	Nov. 20	†8	16	Montevideo, Ltd.	95 -105	..	95
2,061,315	,,	July 24	5⅔	5	Newcastle & Gateshead Con.	18/- -18/6d	..	..
682,856	,,	,,	4	4	Do. 4 p.c. Pref.	73 -74 /	..	..
691,705	,,	Jan. 8	3½	3½	Do. 3½ p.c. Deb.	67½—68½d	..	..
277,285	,,	Nov. 5	5	5	Do. 5 p.c. Red. Deb.	98 -100d	..	..
169,940	,,	Aug. 28	7½	7½	North Middlesex 6 p.c. Con.	115 -120	..	119½
806,160	,,	Aug. 14	5	5	Northampton 5 p.c. max.	76—81	..	..
300,000	,,	Nov. 20	7	9	Oriental, Ltd.	104—109	..	104—108
60,000	5	13 My., '15	—	—	Ottoman	0—¼	..	..
205,162	Stk.	Dec. 18	8	8	Plym'th & Stonehouse 5 p.c.	107 112	..	..
424,416	,,	Aug. 28	8	8	Portsm'th Con. Stk. 4 p.c. Std	115—120	..	..
241,446	,,	,,	5	5	Do. 5 p.c. max.	80—83	..	..
686,312	Stk.	Jan. 22	4	4	Primitiva 4 p.c. Rd. Db. 1911	82 -85*	..	83½ - 84½
389 813	,,	Dec. 18	4	4	Do. 4 p.c. Cons. Deb.	83—86	..	..
150.000	10	Sept. 25	6	6	San Paulo 6 p.c. Pref.	8½ - 8¾	..	..
1,736.968	Stk.	Aug. 28	6½	6½	Sheffield Cons.	105—107e	..	..
95,000	,,	Jan. 8	4	4	Do. 4 p.c. Deb.	77—79e	..	..
90,000	10	June 5	†4	†5	South African	4—6	..	..
6.709.895	Stk.	Aug. 14	7½	5	South Met. Ord.	106—109	+1	106½—108
1,185,812	,,	,,	6	6	Do. 6 p.c. Irred. Pf.	113—116	..	..
1,895,445	,,	Jan. 8	3	3	Do. 3 p.c. Deb.	60—63	..	61
784,000	,,	Sept 11	6½	6½	Do. 6½ p.c. Red. Db.	99—102	..	..
91.500	,,	Aug. 14	8½	8½	South Shields Con.	109 -110d	..	..
1,543,795	,,	July 24	6½	6½	South Suburban Ord. 5 p.c.	102—105	..	103⅝—104⅝
468,837	,,	Dec. 18	5	5	Do. 5 p.c. Deb.	99—102	..	..
647,740	,,	Aug. 28	5	5	Southampton Ord. 5 p.c. max.	75—78	..	..
121,275	,,	Dec. 18	4	4	Do. 4 p.c. Deb.	75—78	..	..
179,014	,,	July 24	8	8	Sutton Ord.	120—130	..	..
94,500	,,	Jan. 8	5	5	Do. 5 p.c. Deb.	96—99	..	..
250,000	,,	Aug. 28	7	7	Swansea 7 p.c. Red. Pref.	98—101	..	..
200,000	,,	Dec. 18	6½	6½	Do. 6½ p.c. Red. Deb.	100—103	..	..
1,076,490	,,	July 24	6⅔	6⅔	Tottenham District Ord.	103 107	..	105½—106½
150,000	,,	,,	5½	5½	Do. 5½ p.c. Pref.	102—105	..	103½
199,005	,,	Dec. 18	4	4	Do. 4 p.c. Deb.	77—80	..	78
85,701	,,	Sept. 25	6	6	Tuscan, Ltd., 6 p.c. Red. Db.	74—79	..	..
309,094	,,	Aug. 28	7	7	Uxbridge, Maidenhead, & Wycombe 5 p.c.	97—102	..	..
88,330	,,	,,	5	5	Do. 5 p.c. pref.	90 -95	..	..
1,180,970	,,	July 10	—	7	Wandsworth, Wimbledon, and Epsom Cons.	112—115	..	..
200,000	,,	,,	5	5	Do. 5 p.c. Pref.	95—98	..	..
488,344	,,	Dec. 18	5	5	Do. 5 p.c. Deb.	100—103	..	101½—102⅝

Quotatio s at :—*a.*—Bristol. *b.*—Liverpool. *c.*—Nottingham. *d.*—Newcastle. *e.*—Sheffield. *f.*—The quotation is per £1 of stock. *g.*—Paid on £10 Shares. * Ex. div. † Paid free of income-tax. ‡ For year. § Div. = 10 p.ct. p.a. less tax and less tax on interim dividend.

(This announcement is inserted gratuitously.)

PETER—WITH ONE EXCEPTION

With one exception Peter is an ordinary little fellow. Chubby, likeable, just five-and-a-half, full of life and fun and on occasions—be it admitted—of naughtiness.

Just now Peter's rather important, for this is his first term at school, and he's grappling with the intricacies of "A B C" and "Twice Two": difficult subjects to all men of five-and-a-half, but even more difficult in Peter's case because—bad luck—he's totally blind. That's his One Exception.

Peter learns reading, writing, and 'rithmetic through the medium of "Braille"—dull stuff compared with the coloured picture books of most five-and-a-halfs. However, he's a stout lad is Peter, and he's making great progress.

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There is a long waiting list of "Peters" throughout the British Isles, for whom training and accommodation must be provided in the immediate future.

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Here's a suggestion. Your eyesight is worth 3d. a year to you. Send Peter and his handicapped pals 3d. for every year you've had it. Now, please, in case it slips your memory. Good idea!

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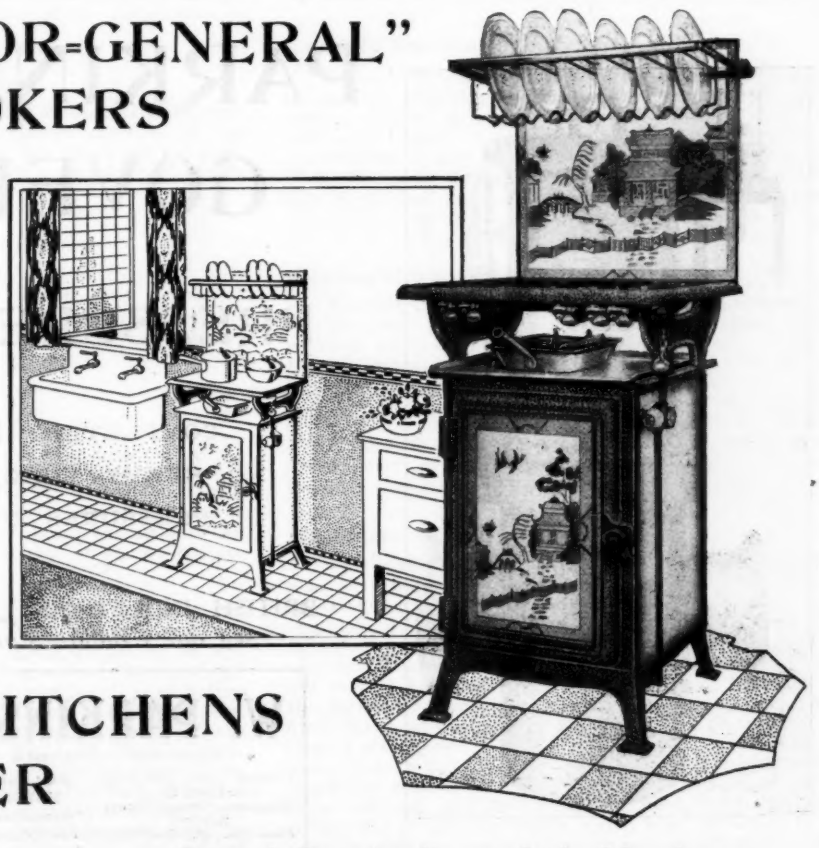

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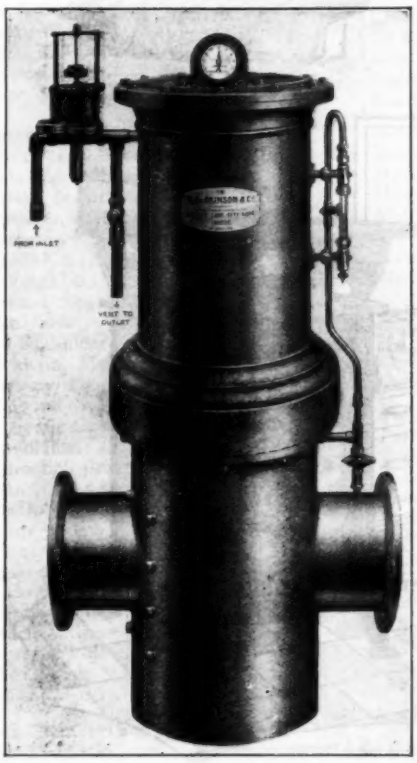

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